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WOUNDS, ULCERS, AND ABSCESSES.

THE TREATMENT

OF

WOUNDS, ULCERS, AND ABSCESSES.

BY

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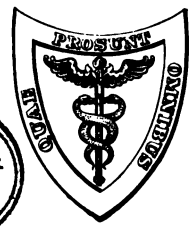

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PREFACE.

In writing this small book I have not attempted to discuss the whole subject of the treatment of wounds as I formerly did in my book on Antiseptic Surgery, nor the various plans which are used by different surgeons, but I have limited myself to describing the methods which I always employ, which I know to be efficient, and which I believe to be the simplest consistent with certainty in the results. Those who have paid particular attention to the treatment of wounds will, I have no doubt, agree with the statement which I have made, that suppuration occurring in a wound made through unbroken skin indicates that the surgeon has committed some avoidable error in his methods, unless indeed the wound is in the immediate neighbourhood of or communicates with some mucous canal; it will not do, with our present knowledge and

experience, to attribute such an occurrence to constitutional defects, to bad materials (for, after all, the surgeon is responsible for the purity of the materials which he uses), &c., it is evident that some error has crept into the manipulations, and it is only by honestly acknowledging this to one's self, and by searching for the fault, that such an occurrence can be avoided on another occasion. I believe that a thorough practical acquaintance with bacteriological work is of the first importance to the surgeon, for in that case the manipulations necessary to keep bacteria out of his wounds become automatic, and he is thus able to concentrate his whole attention on the operative details without having to fear that he may be omitting some detail essential for securing the asepticity of the wound.

75 HARLEY STREET,
LONDON, *July* 1892.

CONTENTS.

TREATMENT OF WOUNDS.

Classes of wounds—Healing of wounds—Healing by first intention—Healing by blood clot—Healing by granulation—Traumatic fever—Septic intoxication—Septicæmia—Pyæmia—Disadvantages of healing by granulation—Advantages of healing by first intention—Causes interfering with healing by first intention or by blood clot—Pyogenic micro-organisms—Their mode of action—Different species—Conditions necessary for their action—Influence of the number of organisms—Variation in virulence—Phagocytosis—Source of pyogenic organisms—Relation to culture media—Relation to heat and chemical substances.

CLASSES OF WOUNDS—WOUNDS MADE BY THE SURGEON THROUGH PREVIOUSLY UNBROKEN SKIN WHERE THE EDGES OF THE SKIN CAN BE BROUGHT TOGETHER.

Listerian method of treatment—Disinfection of skin—Disinfection of instruments—Lotions for use during operation—Irritation—Disinfection and use of sponges—Arrest of hæmorrhage—Ligatures—Stitches, materials, and methods—Button sutures—Buried stitches—Drainage—Dressings—Change of dressings—Rest in the treatment of wounds—Protective—General treatment—Aseptic course of wounds—Listerism in private practice—Asepsis, methods and objections.

FAILURE OF HEALING BY FIRST INTENTION ALTHOUGH THE WOUNDS REMAIN ASEPTIC.

Accumulation of fluid in wounds—Too tight stitches—Movement of wound—Constitutional cause

FAILURE OF UNION BY FIRST INTENTION DUE TO THE OCCURRENCE OF SEPSIS.

This is the fault of the surgeon — Symptoms of sepsis — Treatment —Treatment where pyæmic symptoms occur—Irrigation.

WOUNDS MADE BY THE SURGEON THROUGH PREVIOUSLY UNBROKEN SKIN WHERE, HOWEVER, THE EDGES OF THE WOUND CANNOT BE BROUGHT TOGETHER.

Rest of the part—Lotions—Dressings—Methods of obtaining a satisfactory blood clot—Thiersch's skin grafting in fresh wounds.

SEPSIS IN OPEN WOUNDS.

Symptoms—Treatment—Iodoform in septic wounds—Ointments in septic wounds—Lotions in septic wounds—Skin grafting.

WOUNDS THROUGH THE SKIN WHICH HAVE NOT BEEN INFLICTED BY THE SURGEON, BUT WHICH ARE SEEN WITHIN A FEW HOURS.

Disinfection of these wounds — Lacerated and contused wounds — Compound fractures — Amputation in — Wounds of joints — Wounds of abdomen—Wounds of thorax—Compound fractures of skull—Burns.

WOUNDS WHICH HAVE NOT BEEN MADE BY THE SURGEON, AND IN WHICH SEVERAL DAYS AT LEAST HAVE ELAPSED FROM THE TIME OF THEIR INFLICTION—OPEN GRANULATING WOUNDS.

Methods of disinfection and treatment.

SINUS AND FISTULA.

Simple sinus, causes of—Treatment of—Tubercular sinuses, nature of—Treatment of—Iodoform in tubercular sinuses—Fistula, definition—Forms of fistula—Treatment of the various forms.

WOUNDS WHICH INVOLVE NOT ONLY THE SKIN, BUT ALSO THE MUCOUS MEMBRANE, OR IN WHICH SEPTIC CAVITIES WHICH CANNOT BE DISINFECTED ARE OPENED UP.

Care in making such wounds—Stitches in these cases—Chloride of zinc.

TREATMENT OF ULCERS.

Definition of ulcer—Classes of ulcers.

CHRONIC NON-INFECTIVE ULCERS.

Causes of—Treatment of—Classes of—*Simple ulcer—Inflamed ulcer—Irritable ulcer—Weak ulcer—Phagedænic ulcer—Varicose ulcer—Callous ulcer—Hæmorrhagic ulcer—Pressure ulcer—Paralytic ulcer—Perforating ulcer—Diabetic ulcer.*

TREATMENT OF ULCERS IN GENERAL.

Principles of treatment—Avoidance of movement—Position of part—Massage—Disinfection of ulcers—Iodoform in ulcers—Lotions and dressings—Treatment of painful and inflamed ulcers—Ointments in the treatment of ulcers—Avoidance of contraction—Epidermis grafting—Skin grafting—Thiersch's method—Subsequent precautions after skin grafting—Use of the whole thickness of the skin as grafts—Additional points in the treatment of the various kinds of ulcers—Treatment of simple ulcer, of inflamed ulcer, of weak ulcer, of irritable ulcer, of phagedænic ulcer, of varicose ulcer, of callous ulcer—Blisters in callous ulcer—Martin's rubber bandage—Unna's bandage for ulcers—Treatment after ulcer has healed—Treatment of paralytic ulcers, of perforating ulcer, of pressure ulcer.

CHRONIC INFECTIVE ULCERS.

Tubercular ulcers—Lupus—Scrofuloderma—Treatment of tubercular ulcers—Treatment of lupus—Excision and skin grafting in lupus—Scraping in lupus—Treatment of syphilitic ulcers.

ULCERATING TUMOURS.

TREATMENT OF ABSCESSES.

Forms of suppuration in the tissues—Pathology of acute abscesses—Seats of acute abscess—Mode in which organisms reach the part—Diffuse cellulitis—Subacute abscess.

TREATMENT OF ACUTE ABSCESS.

Method of opening—Dressings—Aseptic course of acute abscess—Acute abscess in glands—Empyema—Acute suppurative periostitis and osteomyelitis.

DIFFUSE CELLULITIS.

Appearances of—Treatment of.

CHRONIC ABSCESS.

Pathology of—Methods of treatment—Removal by dissection—Free incision and removal of wall by clipping and scraping—Scraping, washing out, and subsequent stitching up—Drainage.

TREATMENT OF WOUNDS.

WOUNDS, ULCERS, AND ABSCESSES.

TREATMENT OF WOUNDS.

In considering the treatment of breaches of surface, we have to divide them into two great classes;—first, those which have a tendency to heal more or less rapidly; and secondly, those which extend or ulcerate. In other words, we have to consider the two groups of wounds and ulcers. The treatment of these two classes differs radically in the first instance. In the case of wounds our efforts must be directed to the avoidance of causes which tend to interfere with healing, or which may lead to serious constitutional disturbance: in the case of ulcers we have to remove the already existing causes which interfere with healing, and to prevent certain local troubles which take place during and after the healing process. Then, intermediate between these two classes, we have a group where healing goes on for

a time and then comes to a standstill, where the wound does not extend—that is to say, does not become an ulcer—but where an opening remains on the surface from which a channel leads to the deeper parts, which channel does not heal for various reasons. This form of wound is spoken of as sinus or fistula.

In the first place, we must consider the processes which take place during the healing of a wound. Immediately on the infliction of a wound, oozing of blood occurs from all the open vessels, and coagulates on the surface. At the same time, the injury which has been inflicted on the tissues by the knife leads to the occurrence of a microscopic layer of inflammation, which runs through the earlier stages of slowing of the circulation, stasis, and exudation of lymph. In cases where the two sides of the wound are brought into accurate apposition, and where no further causes of inflammation come into play, this primary inflammation resulting from the action of the knife comes to a stop at the point of exudation of lymph. The exuded lymph glues the two surfaces together, and very soon becomes infiltrated with leucocytes and plasma cells, the latter of which organise into fibrous tissue and permanently unite the two cut surfaces, while, at the same time, epithelium spreads over the surface. This is the process of healing by

first intention, and, when it occurs, there is little or no constitutional disturbance, and little or no pain or swelling in the vicinity of the wound. It is true that, where the wound is extensive, the temperature may rise one or two degrees at the end of the first twenty-four or thirty-six hours, but this rise of temperature is not accompanied by any serious febrile disturbance, and falls again within a few hours to normal. The cause of this rise of temperature, which is spoken of as aseptic fever, is by no means clear, but it may possibly be in part due to reflex nervous disturbance, or in part to absorption of fibrinous material from the wound.

Where the edges of the wound are not brought into accurate apposition, or not brought into apposition at all, the space between the edges of the cut becomes filled with coagulated blood, and a certain amount of lymph is thrown out on the immediate surface in the manner just described. Under certain circumstances, especially where no further causes of inflammation come into play, this blood clot remains in the wound, and forms a mould into which leucocytes, in the first instance, and subsequently plasma cells, penetrate, the latter of which organise into fibrous tissue, while epithelium after a time spreads over the surface. This mode of healing may be spoken of as healing by blood clot; and with regard to the spread of the epithelium over the

surface in these cases, it is to be noted that this does not begin for some time—in fact not till the blood clot has become to a considerable extent organised. Further, also, the epithelium does not spread over the actual surface of the blood clot, but generally penetrates through it at a little distance from the surface, so that, when healing is more or less complete, a thin layer of old unorganised blood clot can be peeled off, exposing the cicatrised part beneath. Here, also, there is no serious constitutional or local disturbance.

In other cases, where further causes of inflammation come into play—more especially in cases where the edges of the wound are not brought into accurate apposition—we have healing by granulation. Here, also, we have the primary inflammation as the result of the action of the knife, and the filling up of the wound with blood clot; but at this point the process diverges from those just described. The blood clot and lymph very soon undergo liquefaction and disappear, leaving the cut surface exposed, and the inflammation in the latter continues to the further stage of destruction of the normal tissues which were exposed in the wound, and the formation of a layer of granulation tissue and subsequently of granulations. These granulations gradually grow and fill up the cavity of the wound, the deeper, that is to say the older layers, becoming

organised into fibrous tissue, which contracts and gradually draws together the edges, thus diminishing the size of the sore, even before the granulations have filled up the cavity or epithelium has begun to spread over the surface. When the granulations have more or less completely filled up the cavity, epithelium begins to grow over the surface, and, gradually, when the conditions are favourable, completely covers it. The superficial layers of the granulation tissue thus protected quickly lose their embryonic character and undergo organisation into fibrous tissue, which also contracts, thus reducing greatly the ultimate size of the scar.

During this process of healing by granulation and suppuration, the patient is very often exposed to severe local and general troubles, especially during the period which elapses before the wound is completely covered by granulations, that is to say, within the first four to six days, when he is more especially liable to the various forms of septic diseases. In the first instance, the temperature rises, and generally in the course of the first twenty-four to forty-eight hours reaches its highest point—about 103 to 104 degrees Fahrenheit. It then gradually falls, till, at the end of a week—that is to say, when the surface is completely covered with granulations—it has generally come back nearly to the normal. This is the condition spoken of

as Traumatic Fever, and it is due to absorption of chemical products formed by bacteria of various kinds, more especially pyogenic bacteria, which are growing in the fluids contained in the wound and in the superficial layers of the tissue. When granulation has completely taken place, this absorption generally ceases, and hence the fall of the temperature. Where the wounds are very large, and contain a great quantity of decomposing blood, a large amount of chemical substances may be rapidly absorbed, producing the condition known as Septic Intoxication or Sapræmia, a condition in which the patient, after a preliminary rise of temperature, passes into a state of collapse, and may die. Further, during the early period, the initial temperature due to traumatic fever may not fall, or, having fallen to a certain extent, may again rise, and the condition of Septicæmia sets in, due probably to the penetration of pyogenic organisms into the body and possibly into the blood, and the poisoning of the blood with the products of their growth. Or again, even after the complete subsidence of the traumatic fever, the patient has a severe rigor accompanied by rapid rise of temperature and an equally rapid subsequent fall; these rigors being repeated and the condition of Pyæmia developing.

As regards the local troubles, and, in the first

instance, as regards those which accompany the early formation of granulations, the edges of the wound become swollen, inflamed, and painful, and in a few days free suppuration is established from the surface. Further, various local septic diseases may take place, such as erysipelas, phagedæna, tetanus, &c. In fact, where the healing process is that of granulation and suppuration, the patient has to pass through a variety of risks depending essentially on the entrance of micro-organisms of various kinds into the wound. Various other local disadvantages result from this process of healing by granulation, such as the presence of unsightly scars; great contraction of the wound pulling on the tissues around and causing marked deformity, as is seen in burns about the neck drawing down the lower lip, in burns about the axillæ causing adhesion of the arm to the side, after sores in the vicinity of tendons or muscles, leading to contraction of these, and so on.

From this short sketch of the healing process, it is evident that in all cases, wherever it is possible, one should strive to obtain healing by first intention or by blood clot, and to avoid the occurrence of granulation and suppuration. By doing so, the patient recovers in a few days, instead of after, it may be, many weeks, without having suffered any pain or constitutional disturbance, and without having run the risks which I

fever, the staphylococci being especially associated with septicæmia and the milder forms of pyæmia, and the streptococci being the cause of the acute forms of septicæmia and of the great majority of cases of pyæmia. Where a wound is freely open to the entrance of micro-organisms, these are not, however, the only ones which may grow in it. The early disappearance of the blood clot and the occurrence of traumatic fever and of septic intoxication are apparently also often associated with, and no doubt in part due to, the growth of ordinary saprophytic and putrefactive bacteria in the fluids contained in the wound, and although these organisms cannot penetrate into or live in the body, their chemical products are often intensely poisonous and cause very serious effects.

The mode in which the pyogenic cocci produce suppuration varies and depends essentially on their chemical action. In the first place, these cocci are powerful peptonising agents, and thus bring about the liquefaction of albuminous materials, and in this way we have the explanation of the rapid disappearance of the blood clot and lymph, and of the liquefaction of the tissues forming the surface of the wound. Further, these organisms during their growth produce substances which are very irritating, and which, when applied in a concentrated form, as, for instance, in

the immediate vicinity of a colony of bacteria, lead to the peculiar form of death of the tissue which is termed Coagulation-necrosis; while in a more dilute solution, or at a greater distance from the colony, they set up all the phenomena of acute inflammation. What the chemical composition of these substances exactly is has not yet been satisfactorily determined, but it is stated that, among other materials which are found, we have, for example, ammonia, and one can readily understand how, if there is a constant production of ammonia in the tissues, a state of inflammation is kept up and spreads co-extensive with the growth of the bacteria, while the peptonising action in the centre of the inflammatory area leads to liquefaction of the intercellular substance, and prevents the coagulation of the material effused from the blood vessels, and thus leads to the formation of a fluid, namely, pus. These organisms also produce substances which, when absorbed into the general system, give rise to the phenomena of fever, these substances being no doubt similar to those formed by many other bacteria, and belonging to the group of albumoses.

The different action of the staphylococci and the streptococci is no doubt partly dependent on the products which they form, and partly also on their mechanical action. As regards their products, it may

be mentioned that the streptococci do not have such a powerful peptonising action as the staphylococci; this perhaps explaining the less rapid formation of pus as the result of their growth. The substances produced by them also seem to be more potent, both in their local and general action, locally leading to death of the tissue in their vicinity, and interfering with the exudation of leucocytes which would otherwise tend to bar their progress. It is possible also that the difference in action may depend to some extent on the fact that, for some reason or other, the streptococci have a special predilection for the lymphatic vessels and lymph spaces of the tissues, along which they extend with great rapidity, while the staphylococci do not seem to have a preference for these parts, and very quickly become walled in by a layer of leucocytes. The mechanical action of the streptococci may also have something to do with their more frequent association with pyæmia, for while the staphylococci when growing in the blood are most usually found either singly or in pairs or triplets, the streptococci tend to grow in long chains, which coil up, and entangling with them blood corpuscles, form emboli, which stick in various small vessels, more especially in the lungs, kidneys, &c., and lead to the occurrence of suppuration around.

It must be borne in mind, however, that it does not necessarily follow that because these organisms gain access to a wound, suppuration and the other consequences must necessarily occur; on the contrary, we know that they must almost certainly have entered many wounds, which, nevertheless, heal by first intention, though I cannot believe that, should they enter wounds where the conditions are not favourable for healing by first intention, they will permit the occurrence of healing by blood clot. I should say that where these organisms have entered a wound only two forms of healing are possible, namely, healing by first intention, or healing by granulation and suppuration. From this we must infer that various conditions must come into play which favour or hinder the growth and action of these organisms. These conditions I have already pointed out in my book on Suppuration and Septic Disease, and I need not, therefore, do more than refer to one or two of the chief points in this place. Perhaps the two most essential conditions which favour the growth and action of these organisms are, in the first place, the amount of injury which has been done to the tissues when the wound was made; and, in the second place, the number, virulence, and variety of the organisms which enter it in the first instance. The relation of pathogenic organ-

isms to the body is that of a fight between the tissues and the invading organisms, and the result of this fight will depend on the vigour of either of the combatants. Where the tissues have been much bruised at the time of the operation or accident, their vitality will have been greatly diminished, and they will more readily succumb to the attack of the organisms than if the injury done to them had been limited to the microscopic layer caused by the action of the knife. This is a point of immense importance to bear in mind in operating on parts where the entrance of organisms cannot be avoided. Under such circumstances the manipulations of the surgeon should be particularly gentle, so that the tissues which are exposed to the action of the organisms should be in as healthy a condition as possible.

The second point which I mentioned with regard to the number of organisms which enter in the first instance is also of great importance, for, as the results of experiments which I published some years ago, it is evident that the effects of organisms depend to a very considerable extent on the numbers which enter the part in the first instance. Thus, in the case of rabbits, it was necessary to inject several millions of the staphylococcus pyogenes aureus into the tissues at one time in order to produce an abscess; while some-

thing like ten times the number was necessary in order to produce a general and fatal infection of the animal. And this same law holds good with regard to all the pathogenic bacteria which have as yet been tested, namely, that in animals not particularly susceptible to a disease, a small number of organisms may be introduced without doing any harm, a somewhat larger number will produce a local lesion, and a still larger number will be required in order to lead to a general infection. And this is no doubt the chief explanation of the comparatively good results which are obtained by many surgeons at the present day who do not employ means to absolutely exclude all organisms from the wounds. Although they do not act rigidly in this respect, they nevertheless cleanse the parts and the instruments, &c., to a considerable extent, and thus reduce the number of organisms which are left in the wound, and consequently diminish their subsequent effect.

Among other conditions in connection with the action of these organisms may be mentioned their virulence, for they apparently vary in virulence at different times, and the more virulent they are, the smaller the number which will be required to produce the effect. Further, the entrance of different kinds at the same time increases their action, because, even though some

of those which enter the wound may not be pathogenic in the true sense—that is, able to penetrate into and live in the tissues—nevertheless, while growing in the fluids of the wound, they produce noxious substances which may interfere with the vitality of the surface, and, if absorbed, with the general vigour of the patient, and thus pave the way, so to speak, for the entrance and action of the true pathogenic bacteria. Here, again, we have an additional explanation of the value of simple cleanliness, in that not only is the number of organisms which enter a wound diminished, but, in all probability, the number of varieties is also less.

The other local conditions which favour the entrance of these organisms may be generally summed up under the heading of those which produce a depreciation of the vitality of the part, such as mechanical injury, cold, the action of chemical substances such as carbolic acid, &c. Lastly, the local effect depends also to some extent on the anatomical character of the part which is the seat of injury. For example, where the peritoneum is opened, organisms, unless in concentrated form and of considerable virulence, are apparently rapidly destroyed,—much more rapidly than where the subcutaneous or muscular tissues are the parts which are involved. On the other hand, the lymphatic spaces,

bursæ, sheaths of tendons, &c., are regions in which these organisms apparently grow with great readiness, and produce violent effects.

As to the mode in which the tissues act in repelling the attacks of these organisms, the favourite theory at the present time is that of phagocytosis—that is to say, it is assumed that the products of certain organisms have an attractive action on white blood corpuscles and plasma cells, thus explaining the rapid emigration of the leucocytes from the blood vessels, and the infiltration of the tissues in the immediate vicinity of the organisms. It is then further held that these leucocytes or plasma cells, or the tissue cells themselves, rapidly take up the organisms into their interior by means of their amœboid movements, and there digest and destroy them. Athough there are strong reasons for believing that in its essential features this theory is more or less correct, it is doubtful whether the mode of action is quite so simple as I have just mentioned, and there are grounds for thinking that, in some cases at any rate, the first action on the bacteria is a chemical one, and is due to the effect of anti-bacteric substances which are present in the serum of the blood and in the fluids effused during the inflammatory process, and that it is only when the organisms have been weakened by the action on them of these substances that the c

are able to take them up and complete their destruction. However that may be, it is certain that the tissues of the body when in a vigorous state have a great power of destroying not only saprophytic, but also pathogenic organisms, provided the latter are not present in too large numbers.

It will be evident from what has already been said that the essential condition which interferes with healing by first intention or by blood clot, and which leads to the various septic diseases, is the entrance of organisms, especially of the pyogenic cocci, into the wounds. I must therefore say a few additional words with regard to these organisms, more especially with regard to their source and the methods by which their vitality and action may be interfered with. The chief source of the pyogenic organisms in the absence of a suppurating wound is the skin and mucous surfaces of the animal body. In former times, before the antiseptic era, it is no doubt true that the infection of wounds chiefly followed as the result of the direct carrying over of pus containing these organisms from one patient to another. The principles of cleanliness and disinfection were not at that time understood, and, consequently, instruments which had been used in a case where suppuration was present retained the infective material, and conveyed it to the next case in which they were

employed; and the same was the case with regard to the surgeons' and the nurses' hands, and the various applications to the wounds. At the present time, however, even where strict asepsis is not carried out, such wholesale infection of wounds very rarely takes place, and, when a wound suppurates, the organisms are most usually derived from the skin of the patient in the vicinity of the wound, or from the fingers of the surgeon or of his assistants. A considerable number and variety of bacteria appear to inhabit the skin, especially in parts where moisture is present,—as in the axillæ, perineum, &c., and there is perhaps no more certain source of bacteria than in the accumulations under the nails; and among these bacteria, especially in parts where moisture is present, the various pyogenic organisms are not uncommonly found. In the mouth, and along the mucous canals, bacteria also grow in large numbers, and among them are organisms which are infective both in man and the lower animals, provided they obtain the opportunity of entering the body. It is less frequent for the organisms to be derived from other sources, though, naturally, instruments which have been employed in dressing surgical cases, unless they are carefully cleansed, may communicate the infective material. Similarly, all dust contains bacteria, and although it is true that, as a rule, these bac

belong to the class of saprophytes, and are generally bacilli, usually in spore form, yet this is by no means always the case, more especially in hospitals where the dust may contain recently dried particles of pus, scales of skin, &c., in which pyogenic cocci may still remain alive, and which, therefore, coming in contact with the instruments, hands, sponges, &c., may lead to the infection of the wound. Of the older surgical dressings, water dressing, lint, charpie, and, above all, poultices were also a frequent source of infection. At the present time, however, the chief source of these organisms is, as I have said, the skin of the patient or the surgeon, and also, to some extent, the dust which settles on surrounding objects.

While speaking of the growth of these organisms in wounds, it is of interest to mention one or two points with regard to culture media when grown outside the body For example, it has been found in the case of many pathogenic bacteria that if grown in the presence of a large quantity of air or free oxygen, they multiply most luxuriantly, but do not produce anything like the amount of poisonous material which they do if air is excluded. It is further important to note that under such circumstances they gradually lose their infective properties, so that after a time they are unable to infect animals when introduced into the body. The

degree of dilution of the nutrient material also affects their growth, and, as a matter of fact, where the amount of water present is much under 90 per cent. they grow with difficulty, and in more concentrated solutions not at all. Hence, concentration of the material in which they are growing, hinders and ultimately arrests their development, whether this concentration be brought about by evaporation of water, or by the addition of substances such as sugar in large amount, as is done in the preservation of fruits.

The most important point, however, which we have to consider with regard to the life history of these bacteria, is their relation to heat and to various chemical substances. Bacteria vary greatly in their relation to heat according to their stage of existence. If growing rapidly, and in the adult stage, they are readily destroyed at comparatively low temperatures but if they have passed into the spore form, they become the most resistent living bodies which are known in nature. Thus, spores of bacteria may be exposed to dry heat considerably above the boiling point of water for hours without losing their vitality; while, on the other hand, the same bacteria if in the adult stage will be destroyed after a short exposure to dry heat of some twenty or thirty degrees above the

temperature of the body. Indeed, a thorough drying will, in a comparatively short time, even without the action of heat, lead to their death. The facts are similar with regard to the relation of bacteria and their spores to chemical substances. Organisms which in the adult stage are readily killed by weak solutions of various chemical re-agents, resist the action of the same substances to an extraordinary extent if in the spore stage. Thus, the spores of anthrax may remain in a 5 per cent. watery solution of carbolic acid for nearly twenty-four hours without losing their vitality; while a few seconds' exposure to the same solution will suffice to destroy the adult organisms. It is fortunate for surgery that the organisms which belong to the class of cocci do not form these resisting spores, and that it is these organisms with which we have mainly to deal. Were it otherwise, attempts to prevent infection of wounds would be almost hopeless. It is true that certain pathogenic organisms which give rise to diseases of wounds belong to the class of bacilli and are spore bearing, the chief of these being the tetanus and the tubercle bacilli; but these pathogenic bacilli are extremely rare in accidental complications of wounds unless directly carried from patients who are actually suffering from the disease, and their avoidance hardly enters into our calculations in operating through unbroken skin. On the other hand, the spores which

may and undoubtedly do often enter wounds, belong to the class of saprophytic bacteria, and, unless under very special circumstances, are unable to develop in the wound or to cause any harm. The pyogenic cocci are, as I have said, very quickly destroyed (in a few seconds) by the action of a 5 per cent. solution of carbolic acid, and the same is true with even weaker solutions of this substance (such as $2\frac{1}{2}$ per cent.), and of various other substances. Of the other antiseptic agents which are employed in surgery, the chief is bichloride of mercury, in a $\frac{1}{1000}$ or $\frac{1}{2000}$ watery solution, and these solutions seem to possess about the same rapidity of action as the solutions of carbolic acid already mentioned. Many other substances have been introduced from time to time into the practice of surgery, but these two antiseptics still hold the chief place.

It must also be noted that although these comparatively strong solutions are required in order to kill these pyogenic organisms, the addition of a very small quantity to the nutrient substance will interfere with or completely inhibit their growth, and it is not, therefore, always necessary to employ materials of such concentration as to cause the death of the organisms. An equally satisfactory effect may be produced provided that a quantity sufficient to prevent their growth is added to the material. This last is a very important

point, because these substances, while they destroy bacteria, also exert an injurious, mainly irritating, effect on wounds, and are also poisonous to the body generally when absorbed in sufficient amount. Another point which is of interest, especially as regards carbolic acid, is that the addition of a small quantity to the nutrient material may diminish the virulence of the organisms, and this is one of the methods employed in attenuating anthrax bacilli. And this may be in part the explanation of the advantage sometimes obtained from the use of carbolic acid by surgeons who do not employ all the precautions necessary to exclude bacteria from wounds.

In speaking of the treatment of wounds, the reader will now understand that the treatment will vary according to the various circumstances of the case, and we must therefore discuss the treatment under these varying circumstances. In the first place, we have two great classes of wounds:—(i.) those which are made through previously unbroken skin, and which do not communicate with mucous surfaces; and (ii.) those which are made through the mucous membrane, or which, if made through the skin, communicate with some mucous canal. This is an important distinction,

because, while, as we shall see, in the first class of cases it is comparatively easy to exclude micro-organisms, in the second class this is practically impossible, and treatment must be directed to minimise their action.

The first class of wounds — namely, those made through the skin, may again be subdivided into (1) wounds that have been made by the surgeon through previously unbroken skin; (2) those where the wound is quite recent, but has not been made by the surgeon; (3) where the wound, also not made by the surgeon, has existed for some days, or where, in the case of a wound made by the surgeon, sepsis has followed; and (4) wounds of still older date which have assumed the form of sinus or fistula.

Of wounds made by the surgeon through previously unbroken skin, we have again two classes:—(*a*) those where the edges of the skin can be brought together; and (*b*) those where the edges of the skin cannot be brought together. Wounds, whether recent or old, which have not been made by the surgeon, may again be divided into incised wounds, lacerated wounds, contused wounds, and burns. Of the old wounds which have passed into the condition of sinus, we have two classes:—one class where we have what may be termed a simple, non-specific sinus, which again may be either aseptic or septic; and the other where the sinus con-

tains some specific new growth in its wall; I refer especially to the presence of the tubercular virus. It will be necessary, in considering the treatment, to refer to each of these kinds of wounds separately.

Wounds made by the Surgeon through previously unbroken Skin where the Edges of the Skin can be brought together.

In such wounds we must naturally aim at obtaining healing by first intention, and in order to get this, we have to provide for rest of the part, for the absence of any mechanical or chemical irritation, and above all for the absence of pyogenic organisms; in other words, in order to make certain of obtaining this result we must treat the wound aseptically or antiseptically. I shall, in the first instance, describe the various precautions which make up the Listerian method of treatment, and which I believe to be in practice far superior to the plan which has been employed on the Continent, more especially by German surgeons—namely, of attempting rigid asepsis as opposed to the employment of antiseptics.

In the first place, as the skin is the most common seat of these pyogenic organisms, it is absolutely essential that

they should be thoroughly removed from it, and this can only be done by the application to it of suitable antiseptic substances; and the substances which are chiefly employed for this purpose are either 1 to 20 carbolic acid lotion, or a strong solution, 1 to 500 or 1 to 1000, of corrosive sublimate. These bacteria growing on the skin inhabit especially the surface epithelium and the outside of the hairs, and penetrate to a slight extent into the sebaceous and hair follicles, and care must be taken that the antiseptic substances employed shall thoroughly impregnate and act on the bacteria contained in these parts. At first the method employed by Sir Joseph Lister for obtaining disinfection of the skin was the simple application to the part for a short time before the operation of a 5 per cent. watery solution of carbolic acid, and he still adheres to this plan. The carbolic acid is certainly much more potent than strong corrosive sublimate, because the surface of the skin is covered with grease, and the carbolic acid having an especial affinity for oily substances, soaks into and impregnates these fatty materials, while, on the contrary, the sublimate solution does not appear to have any such effect, and does not reach and act on the deeper parts. On the other hand, it has been asserted as the result of experiments that this solution of carbolic acid is not efficient for the thorough d and

this is probably correct in certain regions, such as the axillæ, where the sebaceous and hair follicles are large, and where there is an excessive amount of fatty material, but it seems that a sufficiently lengthy application of 1 to 20 carbolic acid to the skin where there are no large hairs or sebaceous follicles, may completely disinfect it. It must be borne in mind that it is comparatively easy to disinfect the *surface* of the skin, and that thus one may avoid introducing organisms at the time of the operation; the difficulty is to get rid of the bacteria from the deeper parts (hair follicles and sebaceous glands), and though as a rule these are innocent organisms, and either do not get into the wound subsequently, or if they do, cause no harm, still it is best to take more thorough measures, so as to get rid of them altogether.

Abroad, the disinfection of the skin is a very elaborate process, means being taken to remove the fat in the first instance, most usually by washing with ether and alcohol, to remove the surface epithelium by the use of the nail brush, and then to thoroughly saturate the skin with various antiseptic materials. In a recent paper by Mr. Lockwood, it has been stated that the ordinary methods of disinfection of the skin are quite inefficient. Mr. Lockwood was not content with the ordinary test of scraping portions of the epidermis from the surface of the skin after the use of the disinfecting agents, but

actually took pieces of the whole thickness of the skin and placed them in various cultivating fluids, and apparently, if his experiments are correct, even the use of very elaborate methods of disinfection failed to answer the purpose. I have very recently taken the trouble to repeat these experiments with totally different results. If only the experiment is done with all suitable bacteriological precautions, I have found that even Sir Joseph Lister's original simple method of applying the 5 per cent. solution of carbolic acid to the skin for half an hour before the operation, was, in a considerable number of cases, satisfactory on the skin of the trunk; and where a somewhat more elaborate method which I shall immediately describe, was employed, I see no reason to doubt that thorough disinfection of the skin may be relied on. It is quite evident that some error in the bacteriological methods has crept into Mr. Lockwood's experiments.

The method which I now always employ for disinfecting the skin is, in the first instance, to shave the part to be operated on and a large area around, and then wash it thoroughly with soap and a mixture introduced by Sir Joseph Lister of 1 to 20 carbolic acid lotion containing a 500th part of corrosive sublimate in solution. Having washed away the greater part of the grease in the first instance in this

manner, I then saturate the surface with turpentine, and after two or three minutes again wash thoroughly with soap and strong mixture, employing a nail brush with the view of removing all the loose epithelium from the surface. This performance takes about five minutes, and is, as far as I can judge, both clinically and bacteriologically, thoroughly efficient; but in parts where disinfection is especially difficult, as in the case of axillæ, or where any error in the antiseptic management might lead to very serious consequences, as, for example, in operations on healthy joints, I generally have the preliminary washing with soap, strong mixture, the nail brush and turpentine carried out an hour or two before the operation, cloths soaked in the strong mixture being then applied and kept on till the time of the operation when the whole process is again repeated. This repetition of the process is also of advantage, because, while doing it, the surgeon at the same time disinfects his own hands, perhaps more thoroughly than he otherwise would. Hence I always do it myself just before the operation.

Special care must be employed in the disinfection of the nails, all the folds about the nails must be thoroughly saturated with the solutions and scraped and all accumulated epidermis and dirt must be removed from beneath the edge of the nail.

All the instruments which come into contact with the wound must also be thoroughly disinfected, and this is generally quite satisfactorily accomplished by immersing them for two or three hours before the operation in 1 to 20 carbolic acid solution. Some surgeons, however, more especially abroad, are much more careful with the disinfection of the instruments, and boil them for ten minutes or a quarter of an hour immediately before the operation. This is readily accomplished by placing them in a perforated tray, which is immersed in water containing a considerable quantity of salt or soda so as to raise the boiling point of the water. When boiled long enough the tray is lifted out of the water and allowed to cool under cover.

For my own part, I believe that except when the instruments have been used for some specially infective bacillary disease such as tetanus, this is an unnecessary precaution; but, at the same time, it is certainly very convenient to have this vessel of water boiling during the operation, in case any instrument which has not been previously prepared is required, or in case an instrument falls on the floor, on a blanket, &c. Such instrument can be immersed in the boiling water for a few minutes, and then be relied on as being thoroughly aseptic. This can, however, be equally effectually, and much more rapidly done by dipping the instrument in

undiluted carbolic acid for a few seconds, and then washing it in 1 to 20 carbolic acid before its use. Naturally, the method of boiling the instruments can only be employed in cases where the instruments are made entirely of metal. I do not myself as a rule boil my instruments as I see no advantage in it, nor do I think that the minute quantity of carbolic acid conveyed to the wound by them when disinfected by immersion in carbolic acid does any harm.

The skin and instruments being in this way thoroughly prepared, precautions must be taken against any further infection of them during the course of the operation, and it may seem superfluous to point out that the hands must, of course, remain wet with the antiseptic solutions from the time that the disinfection has been carried out were it not that one often sees surgeons after disinfecting their hands wiping them dry on towels or blankets, or anything which is at hand, and thus infecting them again. In order to prevent the accidental contamination of instruments, hands, and the skin of the patient, towels soaked in 1 to 20 carbolic acid, or in 1 to 2000 sublimate solution should be arranged around the wound, covering the blankets in the vicinity, so that any instruments or the hands shall only come in contact with this wet and disinfected basis. And further, I always like to

have at hand a basin containing 1 to 2000 corrosive sublimate solution, in which the hands and instruments are frequently dipped during the course of the operation.

During the progress of the operation also, I, from time to time, fill the wound with this same solution by squeezing a sponge into it. I do not think that this is absolutely necessary—at any rate until one comes to stitch up the wound—but, at the same time, it does no harm, is no trouble, and forms an additional precaution. I seldom employ actual irrigation for a wound, even while stitching up, with the exception of cases where healthy joints are opened, as, for example, in wiring a fractured patella, when I like to have a more or less constant stream of warm 1 to 4000 or 1 to 6000 sublimate solution running over the wound during the whole operation.

As regards the sponges, it is becoming the fashion in some hospitals to discard the use of sponges altogether, and to employ in place of them pads of absorbent wool which have been soaked in an antiseptic, but this is a plan for which I see no particular object, and which I consider to be dangerous. I have often seen nurses bring into the room a basinful of these dry pads of non-antiseptic wool which have not been disinfected, and then simply rinsing them in weak anti-

septic solution, squeeze and hand them to the surgeons. Such a plan must be a fruitful source of infection, and a further disadvantage seems to me to be that portions of wool are often left behind in the wound, which is especially dangerous if the wool has not been carefully disinfected. On the other hand, I see no objection whatever to the employment of sponges if proper care is taken, and they are certainly far more efficient for the purpose for which they are required. We may take it as an axiom that any substance which is thoroughly soaked in 1 to 20 carbolic acid watery solution for twenty-four or say forty-eight hours is absolutely disinfected, and therefore one need not fear the conveyance of infective material by means of sponges if they are always kept in these solutions when not in use. As an extra precaution, I generally keep three sets of sponges, one which has only been used in cases of operation through unbroken skin, one which is employed in septic cases, and one which is reserved for tubercular cases; but I must candidly confess that I think that this is a refinement. After the operation, the sponges are thoroughly washed in the first instance in cold water, and then allowed to soak for some hours, then they are again washed in cold water, subsequently in warm water, and then with soap and water, with perhaps a little soda in it. They are then placed in a jar contain-

ing fresh 1 to 20 carbolic acid solution, which must be renewed every two or three days—because the carbolic acid very quickly disappears from it—and they are afterwards kept in this solution. As a rule, a week elapses before they are again employed. When required for use, they are wrung out of the carbolic acid and washed in 1 to 2000 sublimate solution, and the sponges are then placed in a basin containing 1 to 2000 solution, which stands, or is held within reach of the surgeon or his assistant, who wrings them out whenever he requires them. The chief error which is commonly committed in the use of sponges is that the nurse wrings them out of the antiseptic solution, and places them in a dry basin, which very often has not been previously disinfected, perhaps she then does something else—makes the bed, or what not—and without disinfecting her hands, gives the dry sponge to the surgeon, not uncommonly wiping the sleeve of his coat in so doing. All these troubles are avoided if, as I have said, the sponges are not wrung out of the lotions by the nurses, but are kept at hand in soak, and only wrung out immediately before use by the surgeon or his assistant. I ought to state that in the place of 1 to 2000 sublimate solution for the fingers, instruments, and sponges, Sir Joseph Lister has now returned to the employment of 1 to 40 carbolic lotion, but for my own part I prefer the sublimate solution,

more especially because it is less irritating to the hands and to the wound.

As regards the arrest of hæmorrhage, I must confess that I do not pay such particular attention to it as I used to do, or as some surgeons do, because the oozing from the smaller vessels is easily stopped by pressure which I usually employ as a substitute for a drainage tube. As a matter of fact, if, as the operation goes on, all the vessels which spout are clamped with pressure forceps, it will be found at the end of the operation that very few indeed of these vessels bleed; and if the bleeding is only a slight oozing, I generally content myself with torsion; in fact, in any case, I generally twist the vessels before taking off the pressure of the forceps. The result is that only two or three veins, and perhaps one or two of the larger arteries require ligature, and thus much time is saved where the wound is extensive.

As regards the nature of the ligature to be employed, I fail to see the objections to catgut which are advanced by many. Of course, it must be admitted that catgut prepared in the old manner in carbolic oil is very often, as it comes from the instrument maker, a septic material, but it is now a good many years since Sir Joseph Lister abandoned the employment of catgut prepared in this way, and adopted in place of it catgut prepared by sulphurous acid and chromic acid after the manner

described by him some years ago. This catgut, in the course of its preparation, is disinfected, and if it is kept in 1 to 20 carbolic acid for some days before use, it may be relied on as being thoroughly aseptic. The experiments which have been made, and which have thrown doubt on the asepticity of catgut, were made partly with catgut prepared by the oily solutions and partly with dry catgut obtained from the manufacturer, which of course must be covered with bacteria. But that is not the form under which catgut is or should be used. A few days' immersion in 1 to 20 carbolic acid will remove any living bacteria, and it is the rule at the hospital that fresh catgut shall be put to soak in carbolic lotion for at least a week before it is required.

Having completed the operation and arrested the hæmorrhage, we next proceed to stitch up the wound, and here various procedures are adopted. At the present time, the tendency is to omit drainage of the wound as far as possible, and in order to avoid the formation of a cavity in the deeper part in which blood may collect, some surgeons devote much time and care to the insertion of deep stitches of catgut or fine silk, with the view of bringing the deeper part of the wound together. This may be necessary in some cases, where the sides of the wound are formed of more or less rigid

material, as, for example, in the removal of an adenoma from the centre of the breast, and also where muscular fibres have been divided which it is desirable to unite again, but, as a rule, I believe that the deeper parts of the wound can be brought into effectual apposition by means of pressure applied in the dressing, and therefore for my own part, in the great majority of cases, I limit the stitches to the skin edges. Where there has been no removal of skin, there is no difficulty in bringing the edges accurately together without any tension, and in such cases I generally use a stitch of fine silk applied as a continuous suture, after the fashion of the button-hole stitch.

Much has been written and said about the preparation of silk for use as ligatures, or as deep and superficial stitches, and some surgeons take a great deal of trouble in the way of boiling and otherwise preparing their silk. Such measures are, to my mind, absolutely unnecessary. The Chinese twist, as it comes from the manufacturer, is almost quite aseptic; and all that is requisite, to ensure its asepticity, is to keep it for a few days in 1 to 20 carbolic acid solution. It is too often the case that a surgeon pays a great deal of attention to the boiling of his instruments and his ligatures, and forgets to properly disinfect the skin, or omits some other essential step during the performance of the operation.

Of other substances which can be used for stitches, may be mentioned silver wire, which, I think, is only suitable for skin stitches, and not for employment subcutaneously, as is done by some in the treatment of hernia; horse-hair, which is also useful in the skin; silkworm-gut, which may be employed both subcutaneously and superficially; and catgut, especially for mucous surfaces.

In cases where a considerable amount of skin has been removed, it is usually necessary to insert an additional set of stitches, perferably of thick silver wire, with the view of removing the tension on the edges of the wound. These have been termed, by Sir Joseph Lister, "stitches of relaxation," while those which are employed for uniting the edges of the wound are called "stitches of coaptation." Where the loss of skin has not been great, it is sufficient to put in a few stitches of thick silver wire at a little distance from the edge, and to tie the wire in the usual manner; but if a large amount of skin has been taken away, it is well to employ the silver wire in the form described by Sir Joseph Lister as "button sutures"—that is to say, the needle carrying the silver wire is entered at a considerable distance from the edge of the wound and a largish flat piece of lead is attached to the end, the needle is then carried across the wound and passed

out at a corresponding distance from the edge on the opposite side, and to this end also a lead button is attached. In the case of a large wound, such as after removal of the breast, probably two pairs of these button stitches will be required, some half-dozen stitches of silver wire near the edge of the wound, and then a continuous silk suture from one end to the other. It must always be remembered that no stitch must be drawn tighter than is required to secure the object of bringing the edges of the wound into contact. To pinch up the wound, in the way which one sometimes sees done, is to interfere with the circulation in the part, and to introduce an unnecessary element of irritation, which may lead to failure of union by first intention.

In speaking of stitches, I may refer to the subject of buried stitches, employed with the view of preventing the appearance of stitch marks. In many wounds which have healed by first intention, the stitch marks are more evident than the line of incision itself; and it is sometimes a matter of great importance—especially on the face or neck in women—to diminish the scar as far as possible, and there is nothing which conduces more to this end than the avoidance of stitch marks. This can be done by the uniting the deepest portions of the dermis by the finest catgut stitches, these stitches

not passing through the external surface of the skin at all. The edge of the incision is turned outwards, and, by means of a fine curved needle, preferably Hagedorn's, held firmly in a needle-holder, a stitch is passed through the very deepest part of the skin, and subsequently through a corresponding part on the opposite side. The number of stitches necessary to bring the edges of the wound together are, in the first instance, passed, and then they are tied, the knot being pushed into the fat beneath the skin. In this way the deeper parts of the dermis are brought into accurate apposition, and the superficial line of incision is readily united by strips of gauze fixed with collodion. A strip of gauze is fixed along the skin on one side of the wound by means of collodion, and, when this has thoroughly dried, the edges of the wound are pressed together, and the other end of the strip similarly attached to the opposite side. The stitches, if of finest catgut, give no trouble; and when this dressing is removed, about a fortnight after the operation, the delicate line of incision is often barely visible.

A very important question is that of drainage. In the former books which I wrote on antiseptic surgery, I laid very great stress on the thorough drainage of the wound, and at that time it was apparently a matter of great importance. The explanation of that was

probably in the first place that the wound was much irritated during the progress of the operation by the carbolic acid which was constantly poured into it in the form of spray and lotions, and consequently an excessive amount of effusion took place from the blood vessels and collected in the wound rendering an outlet necessary; and further, before the introduction of corrosive sublimate, and before the necessity for great thoroughness in the disinfection of the skin was recognized, there is no question that organisms did sometimes enter wounds at the time of the operation or soon after, and if these wounds contained a quantity of serum, they might grow there and cause disturbance. For two reasons, then, drainage was formerly necessary to carry off the effused serum, namely, in the first place to prevent tension in the wound, and in the second place to remove the material in which saprophytic or other bacteria might grow. Of late, the use of the spray and of carbolic acid as an application to wounds has been given up, and we no longer have a large amount of serum poured out as was formerly the case; the corrosive sublimate seems to answer equally well as a disinfectant, not irritating the wounds to anything like the same extent! In the second place much greater care is taken in disinfecting the skin, and there is less likelihood of organisms entering the wounds at the time

of the operation. In most cases, if a moderate amount of pressure is applied, so as to keep the deep parts of the wound in contact, drainage is not necessary. In cases, however, where an operation has been conducted through unbroken skin, and where there is no reason for suspecting infection of the wound, and where pressure can be satisfactorily applied, drainage is unnecessary. In some cases, however, pressure cannot be satisfactorily employed, and in such instances it is best to insert a drainage tube for a few days. Such cases are, for example, amputations, where pressure cannot of course be applied to the flaps; excision of the breast in feeble and spare individuals, where the skin flaps are thin; after removal of half the thyroid gland, where pressure cannot be applied on account of interfering with the breathing; where tumours are removed from the breast and where the rigid breast substance around prevents proper pressure; in very fat people, and so on. But in the great majority of wounds, as I have said, drainage is not necessary; and in place of it I introduce into the middle of the dressing a sponge, or sponges, of sufficient size to press on the whole area of the wound. Where drainage tubes are employed, as in the cases cited, they need not be left in for more than two or three days, so as to allow any blood or serum which may have formed in the early period to escape.

If the case is dressed in say three days, the drainage tube may be left out and a permanent dressing applied.

The next point is the sort of dressing which should be applied to the wound. The number of antiseptic materials in use at the present time is very considerable, and several of them are quite satisfactory. The one which I now always use is the gauze impregnated with the double cyanide of mercury and zinc, which was introduced some years ago by Sir Joseph Lister. For private work I keep this gauze in a jar containing 1 to 4000 bichloride of mercury solution, and before use wring out the quantity required and place it in a sponge-bag which has been sponged with 1 to 20 carbolic acid. It is apparently necessary to wring out the gauze thoroughly in some weak solution in order to get rid of the quantity of free bichloride of mercury which is apt to be present in it, and which, if applied to delicate skin, may lead to the formation of blisters. I believe that Sir Joseph Lister wrings his gauze out of 1 to 40 carbolic lotion, which, of course, is equally efficient from an antiseptic point of view, but I have become very much impressed with the poisonous action of carbolic acid on young children, and therefore as the mercurial solution is equally satisfactory, and in case there should be any mistake, I use the 1 to 4000 or 1

to 6000 sublimate lotion. It is necessary, of course, to wet the gauze with an antiseptic lotion, before applying it to the wound, not only in order to get rid of the free bichloride of mercury, but also to disinfect it, because this gauze as it comes from the manufacturer and reaches the surgeon's hands, after passing through the hands of various nurses, &c., is covered with bacteria, and, if applied in the dry state to the wound as some surgeons do, for reasons which are not very evident, these bacteria may very readily be communicated to the wound and penetrate into it before any of the antiseptic contained in the gauze has been dissolved in the serum and been able to inhibit their growth. The wound having been stitched up, this gauze is thoroughly wrung out of weak lotion (1-40 carbolic, or 1-4000 sublimate) and applied in a large quantity not only to the wound, but to a wide area around. One of the most common faults which is committed in applying an antiseptic dressing is that the surgeon is too economical, and limits his dressing to a very small area around the wound. The result is that unless it is very tightly bound on, the edge of the wound is apt to become exposed, or, indeed, the dressing may slip off it entirely, while, if it keeps its place, the distance between the edge of the dressing and the wound is so short, that, as I showed years ago, if the dressing is left on for some

days, bacteria will be able to grow protected by the superficial layers of epithelium and reach the wound, and may set up trouble. I think that too extensive a dressing cannot be applied, though, of course, there must be a certain limit to avoid unnecessary waste. Having placed a few layers of gauze over the wound and the surrounding parts, large sponges, according as is necessary, are then thoroughly wrung out of the antiseptic solution and arranged over the region of the wound, of course, only in cases where no drainage tube is employed; further layers of gauze are then placed outside the sponges, and over all a thick mass of salicylic wool, and then a bandage, put on with fairly firm pressure so as to bring the deeper parts of the wound in contact. The moisture in such a dressing very soon dries, and, in the course of a day or two, it becomes a dry dressing, which has certain advantages, in that it adheres firmly to the skin, and that the fluids being concentrated, bacteria cannot spread inwards. The object in employing the salicylic wool is not so much to furnish an additional antiseptic layer as to apply a material, which, while it permits evaporation, at the same time leads to the diffusion of the blood and serum over a considerable extent of the cyanide dressing. The salicylic wool is never really properly absorbent, and the consequence is that the discharges seldom soak

into the wool to any extent, but are diffused through the gauze. As a matter of fact, however, where sponges are employed, the discharge from the wound is extremely slight, and seldom reaches the wool at all.

Such a dressing is usually left undisturbed for about ten days, unless there is some reason for changing it, such as discomfort, fever, or a suspicion of the occurrence of sepsis; but in by far the great majority of cases, no interference is requisite for about ten days. The old rule that dressings required to be changed very shortly after discharge shows itself, is not now necessary. As a matter of fact, it is not uncommon with the dressings I have described, where no mackintosh is used, for blood to appear at the edge of the dressing within a few hours after the operation, but this blood very quickly dries up, and does not form a cultivating medium for the growth of bacteria in the same way as it might do if prevented from drying by a layer of mackintosh. And further, the double cyanide salt is present in the gauze in large amount, and while it is a powerful inhibitory agent against bacteric growth, it is only slightly soluble, and is not, therefore washed out by the first blood which passes through. In the groin, neck, and other parts where there is movement, it may be well to apply a piece of elastic webbing round the

edges of the wound, and also, where it is deep, over the sponge.

When the dressings are changed at the end of ten days the wound is found to be soundly healed, the stitches are taken out, and a small piece of gauze or salicylic wool is fixed over the line of suture for a few days by means of collodion. In changing the dressing, the lotion which I usually employ is 1 to 2000 sublimate, unless in the case of wounds such as those in the axillæ, hernia wounds, varicocele, &c., where it is well to wash the surrounding parts thoroughly with 1 to 20 carbolic solution. I generally use, in order to wash the wound clean, a piece of the deeper layer of the salicylic wool which has just been removed, and which is, being the deeper layer, free from dust and aseptic. The region of the wound should be surrounded by a towel wrung out of an antiseptic solution in the same way as during the operation. There is an advantage in leaving the dressing undisturbed where drainage tubes are not employed, because, as I have said, the discharge from the wound very quickly dries up, and the dressing adheres firmly to the skin, and thus forms a kind of splint which keeps the part at rest. If this dressing is removed too early, the wound is very apt to be disturbed, and the union between the deep surfaces may even be torn asunder. As a rule,

there is no discomfort on the part of the patient which calls for interference, unless it may be that the bandage is tight, and this may of course be removed and a looser one applied after twenty-four or forty-eight hours without disturbing the dressings.

Such is shortly a description of the treatment of an operation wound on the lines which have been laid down and developed by Sir Joseph Lister; but I have already mentioned that in addition to the avoidance of sepsis, which is the chief point to be attended to, the part must be kept at rest and other causes of disturbance avoided. In cases where the wound has been made in the extremities, or over muscles which may be frequently called into action, it is well to place the part on a splint and fix it for some days. In cases where the wound is in the neck, as, for example, after the removal of tubercular glands, it is very important, not only in order to obtain a nice linear scar, but to get good adhesion of the deeper parts, that the neck should be kept completely at rest. This is usually quite satisfactorily done if a large mass of salicylic wool is applied outside the dressing and firmly fixed in its place; but in very restless children it may be desirable to employ a splint somewhat after the pattern described by Mr. Treves, which rests on the shoulder, is fixed around the waist, and runs upwards

towards the head, and ends above in two prongs which grasp each side of the head. In the case, for example, of excision of the breast with the axillary glands, it is of importance to fix the arm to the side for some days, and this is done by means of a broad binder which surrounds the body, including the arm on the affected side, and passes beneath the axillæ of the opposite side.

As regards the avoidance of the irritation of the dressings, this need hardly be taken into account where the wound is closely united and dressed in the manner in which I have described, because the blood which soaks the dressing lying over the line of incision, quickly dries up and fixes the dressing so that it does not rub, and if the bandage is sufficiently firmly applied, there will be no mechanical irritation of the wound from this cause. Where silver stitches are, however, applied, it is sometimes desirable to interpose a layer of Lister's protective oiled silk between the dressing and the edge of the wound, not with the original idea of excluding the antiseptic, but in order to prevent the ends of the wire catching in the gauze, and so fretting and irritating the wound on any movement of the patient.

It need, of course, hardly be stated that the general condition of the patient must be thoroughly attended

to during the treatment of the wound. As a rule it is unnecessary, after the period of chloroform sickness has passed off, to restrict the patient's diet in any way For the first day or two the patient's appetite is usually bad, indeed for the first day he generally retains some effects of the chloroform, and during that time fluids beef-tea, and milk, are probably all that he cares to take; but on the second or third day, light diet may be given—fish, chicken, and so forth, and after the third day he may be allowed to have his ordinary food. It is somewhat difficult to get rid, even yet, of the former tradition of keeping patients on low diet after an operation in the hope of diminishing or avoiding inflammation, and therefore it is well to mention this point specifically. It should also be stated that a laxative will be necessary after the operation, and should usually be administered on the second or third day. Of course, if there is any constitutional conditions present requiring special general treatment such as diabetes, albuminuria, it must be attended to.

After the various points which I have described have been successfully carried out, the wound follows what may be termed a typical aseptic course. As regards the wound itself, the patient may, and very often does experience no pain at all after the operation. Where, however, much tension has been employed

in bringing together the edges of the wound, and also in other cases, especially where sensitive parts have been operated on, or when the patient is himself hyper-sensitive, there may be some and even considerable pain for the first few hours after waking from the anæsthetic, but this gradually and quickly disappears, so that after twenty-four hours the pain is only evident on movement, and after thirty-six or forty-eight hours the part is perfectly comfortable. The continuance or subsequent occurrence of pain in the wound would raise the suspicion that something was not quite right.

If the wound is looked at during the early period, it will be found that the skin is of a perfectly natural colour, that there is no swelling or tenderness of the edges, that, in fact, it presents the same appearance as it did immediately after the stitches were inserted; and even at a later period, when the dressing is finally removed, unless the stitches have been tight, there is no evidence of any irritation of the wound at all. In cases where the stitches have been very tight, one or other of them may be cutting its way through the skin to some slight extent, and around these there may be a slight blush of redness and a slight tenderness.

The constitutional condition of the patient is also practically undisturbed. For a few hours, and even in

some cases for twenty-four or thirty-six hours, the patient is sick or feels uncomfortable as the result of the anæsthetic, but after the second or third day, especially after the bowels have acted, the appetite returns, and the patient feels in his usual state of health. The temperature on the evening of the operation is usually either normal or slightly above it, or, if the operation has been a very severe one, may be sub-normal. Towards the end of the twenty-four hours, however, in cases of operations of any considerable extent, it rises it may be to from 100° to 101° Fahr., but it again rapidly falls, so that by the end of the second day it has generally returned again to normal, and there is no further variation unless some accidental disturbing cause comes into play.

One word with regard to private practice. The Listerian method of treatment is quite readily carried out in private practice. In most cases a nurse will be in the house for some hours at any rate, very possibly the night before the operation, and she is instructed to wash the skin thoroughly with turpentine and the strong mixture and soap some two or three hours before the time of the operation; or, if she is in the house to do this on the previous evening, leaving a cloth wet with 1 to 20 carbolic lotion, and covered with mackintosh over the part after it has

been washed, unless in the case of children. As regards the lotions, it is not necessary to carry the lotions made up to the proper strength, one carries some undiluted carbolic acid and a number of compressed pastiles of corrosive sublimate, and by means of these solutions of the required strength can be made in a few minutes. As to the disinfection of the instruments I generally thoroughly scrub my instruments with 1 to 20 carbolic acid before putting them away after an operation. They are kept in a glass instrument press, which is from time to time washed out with 1 to 20 carbolic acid, and which is almost entirely dust-tight. When required, therefore, in a hurry, they are in reality pure, and a comparatively short immersion in 1 to 20 carbolic acid will remedy any accidental contamination which may occur after they are taken out of the glass press. If, however, there is any reason to suspect any particular instrument, it is certainly disinfected if plunged into the undiluted carbolic acid which is carried by the surgeon for the purpose of making his solutions. The sponges after an operation are washed as before described, and kept in 1 to 20 carbolic acid. When required they are wrung out and carried in a sponge bag, which has been thoroughly rinsed in the same solution. The dressings are also carried in pure sponge

bags. The catgut and silk are carried wound on reels, which are kept in 1 to 20 carbolic acid in a glass-stoppered bottle. Turpentine is obtainable practically in any house. In this way the treatment is carried out in private practice with the same certainty as in hospital, and without any material trouble.

I have already referred to methods which are employed—more especially by certain German surgeons—in which the use of antiseptics are as far as possible avoided. Their methods are undoubtedly theoretically perfectly correct, and practically can be successfully carried out by a skilled bacteriologist, but the risks of error are so great—and from the absence of antiseptic solutions there is no possibility of correcting them—that an ordinary surgeon, who has not had a prolonged bacteriological training, will find it a matter of the greatest difficulty, indeed, almost impossibility, to obtain results which are at all comparable with those which he would obtain were he to use the Listerian method; and for this reason, although I shall, in a few words, mention the methods, I should strongly dissuade any one from attempting to employ them. To my mind they possess no practical advantage over that which I have just described, while, as I have

said, they are much more complicated, although, from a superficial point of view, apparently much more simple. This will be evident in the course of my description.

In this method of treatment the greatest precautions are taken to disinfect the skin both of the patient and of the operator, it being thoroughly scrubbed with ether, permanganate of potash, oxalic acid, and a variety of substances, much time and trouble being spent over it. Here the use of antiseptics ceases. After the thorough disinfection of the skin, the antiseptics are washed away, both from the hands of the surgeon and the skin of the patient, by sterilised water. The instruments are boiled and placed in sterilised water or sterilised salt solution; the ligatures and stitches are boiled and also placed in sterilised water. As a substitute for sponges, wool which has been sterilised by dry heat is usually employed, and the greatest care must be taken during the operation not only not to introduce any disinfectant into the wound, but also not to infect any of these sterilised materials.

Now it is quite evident to any one who has attempted to make cultivations of bacteria that such a method of treatment must be carried out under extreme difficulties in an operating theatre, and, as a matter of fact, from the knowledge of these difficulties the precautions

are in some places carried still further. Separate clothes are employed by the surgeon and his assistant, the air which enters the theatre is filtered, and indeed, in one or two institutions, they have gone the length of separating the auditorium from the area of operation by a wall of plate glass. In an ordinary theatre, without these precautions, it is practically impossible to avoid infection of the hands, the instruments, the sponge pads, and so forth, with dust from the air, from surrounding objects, from the breath of the people around, &c., and this is still more likely to happen if the operator has not had enormous experience in bacteriological work. I do not, of course, mean to say that sepsis must necessarily result from such infection, for, in my preliminary remarks, I have already referred to the various conditions which are necessary; but, at the same time, sepsis must be constantly liable to occur. Even in cases where the operator and his assistant are enclosed in a glass case, the results are not commensurate with the trouble, for, after all, no better results can be obtained or desired than those got by the Listerian method of treatment, and there such extraordinary precautions are not necessary, because antiseptic lotions are constantly at hand to correct any fault of the operator, or any accidental infection; and, after all, the irritation of the antiseptics—the avoidance of which is

the whole aim of this complex procedure—does not, as a matter of fact, interfere with the progress of the wound.

After the operation has been completed in the manner described, the dressing employed is usually wool which has been sterilised in an oven by dry heat, and which is brought to the side of the operating table in unopened cases. Large masses of this wool are applied, and subsequently fixed on with bandages. I think it is quite unnecessary, after what I have said, to take up time and space in describing this method which, in my opinion, is really, as regards the great majority of operations, a surgical curiosity. No doubt in operations on the eye, asepsis, as contrasted with antisepsis, is the best treatment; but then, beyond proper disinfection of the instruments, there is usually no further trouble.

Failure of Healing by First Intention, although the Wounds remain Aseptic.

It is but seldom that healing by first intention fails where the causes of sepsis are excluded, and where the wound has been treated in the manner previously described; at the same time, it does occasionally happen through accidental circumstances. Perhaps the most

frequent cause of failure of healing by first intention of the deeper part of the wound is accumulation of blood or serum in it, which distends the wound and separates the two cut surfaces. This is usually due to imperfect arrest of the hæmorrhage at the time of the operation, use of too strong antiseptic solutions, or of unequally applied pressure afterwards. I have especially noticed it also in cases of wounds in very fat subjects, and in these persons I generally employ a drainage tube for two or three days. Although, however, the deeper parts of a wound may be in this way prevented from adhering, union by first intention usually occurs along the whole line of incision in the skin, and, where the accumulation is not great, it may become absorbed in a few days. As a rule, however, where it is evident that serum has accumulated at some part of the wound, time will be saved by gently separating the union of the skin in the vicinity by means of a pair of sinus forceps, introducing a small drainage tube into the cavity containing the accumulation, and leaving it in for a few days.

Another cause which may interfere with satisfactory union by first intention is the presence of too tight stitches. Where there has been considerable tension employed in bringing the edges of the skin together, the stitches may cut out and allow the edge of the

wound to gape before a sufficiently strong union has occurred. Indeed, during the process of cutting out of the stitches, there may be so much inflammation in the immediate vicinity as to prevent satisfactory union at that part. This condition is best avoided by employing a large number of thick stitches close together where the tension is greatest. In this way the pressure is distributed over a considerable area of the skin, the irritation caused by the individual stitches is very much diminished, and there is not the same tendency for them to cut their way out. In connection with this point, also, it must be mentioned that in such cases one must not take out the stitches too early, that, where the tension is considerable as, for instance, in some cases of excision of the breast, the stitches should be left in at the point where the removal of the skin has been greatest for at least a fortnight, otherwise, after they are taken out, the wound, which at the time was fairly firmly united, may give way and an open sore result. This is a matter upon which no definite rules can be laid down, but it must be left to the judgment of the surgeon in the individual cases.

Then again, where movement of the part is permitted, the edges of the wound become irritated and to some extent inflamed, and union by first intention may not occur. Where union fails in these cases, there

is usually no objection to putting in fresh stitches and bringing the edges of the skin together again; if this is done, healing is often obtained at once, provided the part is placed at rest.

In other instances, though rarely, a cause of the non-union may be that the incision through the skin has been improperly made (usually obliquely), and that a narrow portion of the edge has sloughed; or again, the cause is to be sought for in some constitutional condition of the patient. In old people union naturally does not occur so quickly or so soundly as in young individuals, and the same is the case where the patient is suffering from some grave constitutional disorder, such as diabetes or Bright's disease, or even only from extreme weakness. The treatment of these cases must of course involve the treatment of the local or constitutional cause.

In none of the cases just alluded to does suppuration occur.

Failure of Union by first Intention due to the occurrence of Sepsis.

By far the most frequent cause of failure of union by first intention is, however, the failure on the part

of the surgeon to exclude the pyogenic organisms Where we have to deal with unbroken skin at some distance from the mucous canals, such failure is practically entirely due to imperfection in the methods employed by the surgeon, whether it be in his actual manipulations or in the asepticity of the materials which he employs. In either case, the occurrence of suppuration under such circumstances is, as I have already indicated, the fault of the surgeon, and such failures are naturally diminished by practice in the employment of these methods, and are quite uncommon occurrences in the hands of those who have had a previous bacteriological training.

In describing the Listerian method, I have here and there indicated errors which might occur, but the errors which are in reality committed are so numerous, and in some cases so extraordinary, that it is quite impossible for me to refer to them. When this septic condition occurs, we no longer have the typical aseptic course previously described. The pain, instead of disappearing, increases after the first day, and assumes a throbbing, tense character, the edges of the wound become red and swollen, and the whole wound becomes distended with exudation; at the same time, the temperature, instead of falling after twenty-four or thirty-six hours, goes up, and assumes the type of traumatic fever formerly

referred to. The patient, instead of being well after the effects of the anæsthetic have passed off, becomes ill with loss of appetite and other symptoms of fever, and in the course of two or three days, if the wound is opened up, pus will be found to be present in it.

Where these symptoms occur, it is, of course, necessary to change the dressings in order to ascertain the condition of the wound, and if there is any suspicion that suppuration has taken place, the necessary stitches should be removed from the most dependent part of the wound which is then opened up, and a large sized drainage tube inserted. As a rule, it is not advisable to wash out the wound; to do so is only to irritate and damage unnecessarily the inflammatory tissue, and possibly to precipitate, or at any rate to favour, the entrance of the organisms into the system. Provided there is a free exit for the pus, it is best not to squeeze or wash out, or in any way irritate the wound. It is well still to retain the antiseptic dressings previously described, but they must now be changed daily, till the amount of discharge diminishes. Where no general infection has or is about to take place, the temperature will fall and the other general and local conditions improve as soon as a free exit is provided for the discharge. In the course of a few days the suppuration will cease, and the discharge become serous; and if

everything goes on well, the drainage tube may be left out in from ten to fourteen days. Where, on the other hand, the temperature keeps up, and the other symptoms continue, we must suspect either that there is some recess in the wound from which the discharge has not been properly evacuated, or that some general infection is occurring. In either case, the wound must be thoroughly and completely opened up and cleansed, all recesses must be freely exposed, and, especially where there is no sufficient retention of discharge to account for the continuation of the general symptoms, it is well, with a sharp spoon, to remove the granulation tissue, so as to get rid of any organisms which may be penetrating into the body. The wound should then be sponged over with undiluted, liquefied carbolic acid, and should be stuffed with cyanide gauze sprinkled with iodoform, and, for a time at any rate, made to heal from the bottom, the stuffing being renewed daily. If as the result of this procedure the temperature falls and the general disturbance subsides, one may, in a few days, discontinue the stuffing, and after introducing a drainage tube, stitch up the wound again.

Where the general symptoms, especially the occurrence of rigors and sudden elevations of temperature, lead one to suspect pyæmic infection, one should, on opening up the wound, carefully look for some throm-

bosis of veins, and if this is found, the main vein above the thrombosed area should be ligatured and divided in order to cut off the local source of infection from the general circulation. Where, however, the general symptoms continue in spite of this energetic local treatment, one can only treat the patient on general principles, supporting his strength by stimulants, administering as nutritious a diet as he is able to digest, keeping down the temperature where it is excessively high by means of febrifuges, attending to the state of the excretions, &c.

As regards local treatment under such conditions, it is probably best to go on with the stuffing of the wound with gauze saturated with iodoform; or where the wound is extensive, or contains sloughs, or where there is a diffuse cellulitis in its neighbourhood, it may be advisable to employ constant irrigation with the view of washing away the septic material as soon as it is formed. In carrying out irrigation of the wound, precautions must, of course, be taken against wetting the patient by making suitable arrangements of mackintoshes or tin vessels in the case of the extremities, &c. The fluids used should be tepid and mildly antiseptic. To employ strong antiseptic solutions is only to injure the granulation layer, and predispose it to the entrance of organisms without doing any good; and further,

patients in this septicæmic condition appear to absorb fluids very readily from the wound, and if poisonous antiseptics, such as carbolic acid, are employed for irrigation, the patient may suffer from general poisoning as the result of their absorption. I believe that the best solutions for irrigation of wounds under these circumstances are either dilute sanitas or dilute permanganate of potash. The nozzle of the tube which carries the fluid to the wound should actually lie in it, and the fluid should not be allowed to drop on to the wound from a height, such dropping causing in a very short time severe pain. In order to prevent the skin from being sodden by the fluid, it should be carefully oiled; and, further, as the granulations are apt to become œdematous from long soaking with the fluid, it is well from time to time, especially where improvement is taking place, to intermit the irrigation for a few hours, and to substitute for it the ordinary gauze dressing.

WOUNDS MADE BY THE SURGEON THROUGH PREVIOUSLY UNBROKEN SKIN WHERE, HOWEVER, THE EDGES OF THE WOUND CANNOT BE BROUGHT TOGETHER.

In these cases, also, our chief aim must be the exclusion of micro-organisms, and if this is successfully accomplished, and steps be taken to keep the part at absolute rest, and to prevent, as far as possible, the irritation of the dressings, healing will occur by blood-clot. Perhaps most commonly where the wound is large, healing goes on to a considerable extent by blood-clot, and then, as the result of the irritation of the surface, a small part in the centre may undergo a slight degree of granulation before healing occurs. Now, however, except in cases where a large cavity is left, as, for example, in cases where holes have been gouged in bones, one can usually hasten the healing process and obtain cicatrisation of the wound almost as rapidly as in healing by first intention, by the employment of Thiersch's method of skin grafting. Where skin grafting is not employed, the treatment is essentially the same as that described in speaking of wounds where the edges are brought together (page 46, *et seq.*), but special care must be taken, in the first

place, to thoroughly fix the part, so that the blood-clot shall not be torn or injured by movement; and, in the second place, to prevent the irritation of the surface of the blood-clot by the antiseptics employed, or by the material of the dressing itself. To carry out the first essential, the employment of splints in the case of the extremities, or of firm bandaging where the trunk is the part which has been operated on, is requisite, as much of the wound as possible being of course stitched up. The exact plan must naturally depend on the site of the operation. The irritation of the dressing is avoided by interposing between the gauze and the surface of the wound a piece of protective which has been in the first instance purified in 1 to 20 carbolic lotion, and subsequently dipped in a weak solution of corrosive sublimate. This piece of protective must only be slightly larger than the wound, and must not reach at all near the edge of the dressing, otherwise septic bacteria could spread in beneath it. The lotions employed in dressing the wound should also be as non-irritating as possible, and for this purpose I generally use 1 to 4000 bichloride solution, with which the wound is douched, or very gently sponged with a bit of salicylic wool as previously described. The surrounding skin, however, must be more thoroughly disinfected, either with 1 to 2000 bichloride solution, or better, with

1 to 40, or even 1 to 20 carbolic lotion, care being taken that these strong solutions do not run on to the surface of the blood-clot. The dressings should be changed as seldom as possible, in the first instance probably not for ten to fourteen days, and subsequently at intervals of eight to ten days.

In some cases this healing by blood-clot does not take place satisfactorily because the cavity is deep and sufficient blood may not be effused to fill it up, or because the clot is not firm enough to remain permanently in the part. In such instances, one would not arrest the bleeding too carefully, and various materials have been employed with the view of entangling the blood and leading to its coagulation in the part. For instance, fragments of catgut, or loose, irregular coils of catgut, may be laid in the wound, and this will form a frame in which the clot is caught. In other cases, pieces of sponge which have been deprived of their siliceous materials and then made aseptic are laid in the wound; or where a cavity has been made in the bone, portions of the healthy bone which may have been removed may be clipped into small fragments and replaced in the cavity. In cases where the blood-clot is not sufficiently satisfactory, a certain amount of granulation of the wound, or of the partially organised blood-clot will occur; but if the wound has been kept

aseptic, there will be no suppuration. This formation of granulations will not go on to any material extent, and consequently the subsequent contraction of the wound or deformity from pulling on neighbouring parts will be comparatively slight.

This process of healing by blood-clot is, however, a slow one, depending on the amount of clot which has to become infiltrated with new cells and organised, and naturally, where there is not a deep cavity, it is much better to obtain immediate healing of the wound by means of Thiersch's skin-grafts.

In the method of treatment by skin-grafts, after the bleeding from the surface of the wound has been completely arrested, the whole surface is covered with layers of skin taken from other parts of the body. In Thiersch's method, after thorough purification and shaving of the skin, long strips, as long and broad as possible, and of about half the thickness of the true skin, are taken by means of a razor, and immediately transferred to the surface of the wound, on which they are carefully spread out with the epithelial surface uppermost. They are so arranged that each strip slightly overlaps its neighbour till the whole wound is covered, and at the margin the strip slightly overlaps the true skin. After the layers of skin have been applied, strips of protective, washed first in 1 to 20 carbolic acid, and

subsequently in 1 to 2000 sublimate, are placed over the wound so as to completely cover the grafts, and when placed first on the part, these pieces of protective are pressed firmly, so as to expel all blood or bubbles of air which may remain beneath the graft, and which might interfere with its proper adhesion to the cut surface. The ordinary gauze dressing is then applied outside the protective, and the dressing is not changed for a week or ten days, at the end of which time it will be found that the grafts are adhering all over, and that the wound has healed. Further details of the method of skin-grafting will be found under the treatment of ulcers. At first it was thought that these grafts would only adhere to a highly vascular surface, such as a granulating wound; but experience has shown that they may be confidently applied to the freshly-cut surface of a wound, and although no doubt the adhesion is more certain and firmer in the first instance if a vascular tissue, such as muscle, is exposed, nevertheless, in the great majority of cases, unless perhaps in very fat individuals, adhesion to the fat exposed in the wound occurs perfectly satisfactorily.

Where these wounds become septic, as a consequence of some error in the aseptic treatment, or in the dress-

ing, the results, as regards the patient, are not usually of a very serious character—unless, indeed, the wound communicates with a cavity in the bone, with the interior of a joint, &c. In the latter cases, of course, very serious inflammation may follow in these parts; but where the wound simply involves the subcutaneous or muscular tissues, the disturbance is, as a rule, comparatively slight. The reason for this is that the wound being widely open, the septic materials readily flow away into the dressing, and only a comparatively small quantity becomes absorbed. Nevertheless, even here, if the wound is at all large, the temperature rises in the first instance, and a varying degree of traumatic fever occurs; the surface and the edges of the wound also swell, and become red and painful, and in the course of two or three days the surface of the wound becomes covered with a layer of granulation tissue, and subsequently of granulations, and there is a profuse flow of pus from the part. The subsequent history of such a case, provided no general infection has occurred, is simply that which I have already described under the heading of "Healing by Granulation."

As regards the treatment of such an accident, as soon as it is recognised that sepsis has probably occurred, or as soon as the rise of temperature and tenderness in the part leads one to suspect its occurrence, the dressing

should be removed, and if it is then evident that the aseptic treatment has failed, the surface of the wound should be thoroughly cleansed and all adhering portions of blood-clot taken away. As to the best method of dressing to employ under these circumstances, much will depend on the degree of constitutional disturbance. If there is much constitutional disturbance, it is well, in the first instance, to change the dressings frequently; or, still better, to employ for a day or two continuous irrigation with a mild antiseptic solution, in the manner formerly described (page 67). In any case, till granulation is complete, and even afterwards, if the discharge is profuse the dressing should be changed twice a day. As regards the material to be employed for dressing, I think it is best, even although sepsis has occurred, to go on, in the first instance, till the wound has thoroughly granulated, with the ordinary cyanide gauze dressing. These dressings absorb the discharge very readily, and growth of bacteria is rapidly arrested in the discharge which soaks into them; while it is probable that a certain amount of the cyanide becomes dissolved in the liquids of the wound, and thus the amount of decomposition in the part is considerably diminished. There is a further advantage in going on with the dressings in that the organisms which may have entered the wound, in the first instance, may be comparatively harmless,

and, if the dressing is continued, others are kept out; while, on the other hand, if an ordinary water-dressing or a poultice were applied in addition to the original organisms which entered, others, which might be very much more virulent, would gain access to the wound, and besides, it is not at all improbable that the organisms growing in a wound in which there is a small quantity of antiseptic material, may have their virulence very distinctly diminished. Indeed, admixture with carbolic acid is, as I have already mentioned, one of the methods which have been employed for depriving pathogenic organisms, such as anthrax, of their virulence.

Where the suppuration is profuse, or where there is regular putrefaction of the discharge, iodoform is of considerable value. The use of iodoform as an antiseptic is a subject which has occupied much attention, and about which there are very different opinions, but as the result of much debate and many experiments, it seems to be pretty clearly established that iodoform is not an antiseptic in the ordinary acceptation of the term, that is to say, it does not kill bacteria, nor does it even interfere with their growth, in the first instance at any rate. But it also seems to be established that while iodoform does not kill or inhibit the growth of bacteria in the first instance, it nevertheless breaks up the products of the bacteria, and in doing so, is itself

decomposed, iodine being liberated, and then a certain degree of inhibition of the bacteric growth occurs from the presence of the free iodine. Thus, while I cannot at all approve of iodoform as a dressing in wounds made by a surgeon through unbroken skin, where the aim ought to be to exclude all bacteria from the wound, nevertheless, where a wound has once become septic, iodoform is often a very valuable aid in breaking up the products of the bacteria, and in subsequently interfering, to a certain extent, with their growth. I cannot but think that a good deal of the sepsis which occurs in wounds, and which is attributed to stitches, catgut, &c., is really in part due to the way in which these wounds are sprinkled with dry iodoform, and in which iodoform is trusted as an antiseptic after-dressing. As the iodoform has no antiseptic power, it follows that when it is kept in bottles exposed to dust, &c., it will contain living organisms, and when sprinkled on a wound from such bottles will convey these organisms to the wound, and this has actually occurred in many cases. If iodoform is to be used in recent wounds, it itself must be disinfected, either by previous prolonged immersion in 1 to 20 carbolic acid, and subsequent drying under cover, or in some other way.

When granulation has completely occurred, the healing of the wound will take place more rapidly by the

substitution of mild antiseptic ointments in the place of the gauze dressings, for the gauze itself has a mechanical irritating effect on a wound, and is in reality an excellent means of promoting granulation where this process is sluggish. Among the ointments which may be employed in this way, perhaps the best is boracic ointment, but if used of the ordinary pharmacopœial strength it will not unfrequently be found to be too irritating, and after a time to interfere with the healing of the wound, and therefore it is best, when cicatrisation has commenced, to dilute the boracic ointment to half or quarter strength; eucalyptus ointment, containing from 1 to 10 to 1 to 30 parts of oil of eucalyptus, is also an excellent dressing, and appears to be specially useful in the case of burns. Where the granulations are not œdematous, and where the use of ointments is not desirable, Sir Joseph Lister's original method of using boracic lint and protective answers extremely well: the wound being washed with the antiseptic lotion, a piece of protective, dipped in an antiseptic, say 1 to 2000 bichloride, is placed over the wound, and outside that a much larger piece of boracic lint, which overlaps it in all directions. This may be changed once or twice a day, according to the amount of discharge, and the degree of sepsis.

As regards the lotions, it is useless to employ strong

antiseptic solutions to the surface of the wound. They cannot by any possibility disinfect the wound, because the organisms are located in the recesses between the granulations and in the surface of the tissue itself, and their only effect will be to irritate the surface and weaken it, and thus aid the extension of the septic process. I believe that the best solution is 1 to 2000 or even 1 to 4000 bichloride of mercury, but the skin around may of course be washed with 1 to 20 carbolic acid in order to disinfect the decomposing material.

Where the wound is large, skin grafting may be employed as well, but the sore must previously be rendered aseptic. Such granulating surfaces can be rendered aseptic by sponging them over with undiluted carbolic acid, the skin around being thoroughly scrubbed with 1 to 20 carbolic lotion, a dressing soaked in 1 to 2000 bichloride being subsequently employed. If this fails, disinfection will certainly be obtained by scraping away the surface layer of granulations, and then applying the undiluted carbolic acid as just described. The application of Thiersch's grafts to these granulating surfaces will be more fully described under the heading of ulcers, but it consists essentially in the scraping away of the superficial layer of granulations before the application of the graft in order to get a smooth, vascular and aseptic surface on which to place the grafts.

Wounds through the Skin which have not been Inflicted by the Surgeon, but which are seen within the course of a few Hours.

The treatment of recent incised wounds which have not been inflicted by the surgeon depends, of course, on the site and nature of the injury which has taken place, but in the first instance we may consider the treatment of an incised wound involving the soft parts alone. In the great majority of such cases when the wound was inflicted organisms were introduced at the same time, and this is more especially the case where we have wounds, say of the scalp, where portions of the hair have been carried in, or of parts of the body covered by clothing, where portions of the clothing may also have got in. Or, again, it may be that a wound which may fairly claim the name of an incised wound has been inflicted by a sharp stone or some other implement which is covered with earth or dust. In any case, we have to do with a wound which in all probability contains bacteria varying in number and in kind. In many cases, no doubt, where the wound has been inflicted by a knife, it will heal by first intention if the bleeding is arrested, the wound cleaned

out, and the edges kept together, but in many instances it is not wise to trust to the energy of the body in destroying the bacteria which may have entered, or to trust that these bacteria may be few in number, and therefore, with the view of carrying out the essential point in wound treatment, it is necessary to take steps to destroy the bacteria which may have entered. This is more especially the case where the wounds have been made by a stone, where earth is carried in, and where, as by no means uncommonly happens, the tetanus bacillus has been introduced. It is also very important, when the wound is situated on hairy parts, such as the scalp, where scurf or portions of hair have entered, and will almost certainly lead to septic changes.

In order to carry out the disinfection of the wound, it should be held freely open, or, if it is of the nature of a punctured wound, the skin incision should be enlarged and then, being held freely open, the wound must be thoroughly washed out with a strong antiseptic solution, preferably 1 to 20 carbolic acid. Where much dirt or grease has entered, it becomes a matter of considerable difficulty to thoroughly disinfect the part, and in such cases it may be necessary, in addition to merely washing out the wound, to scrub away the earth or dirt by means of a nail brush. Of course, for such

treatment the patient must be under an anæsthetic. In cases where earth has entered, and where, therefore, there is very considerable risk of tetanus for instance, it is, I believe, safest to sponge the surface of the wound, after getting away as much of the dirt as possible by means of a nail brush, with undiluted carbolic acid. The undiluted carbolic acid does not produce visible sloughs, and does not materially retard the healing process, while anything less potent will not, with certainty, destroy the tetanus organism. Having disinfected the wound in one or other of these ways, parts of it may be stitched up where the line of incision is fairly clean cut, but a drainage tube must be inserted, partly because there will be a very considerable amount of effusion after the rough handling, and partly lest the attempt to disinfect the wound shall have failed and suppuration after all take place. Otherwise, the method of dressing is the same as described on page 46 *et seq.*, and should sepsis occur, the treatment must follow the lines described on page 65 *et seq.* I need only here repeat the objection which I have to washing out septic granulating wounds with antiseptic solutions, as being a method which does not in any way interfere with the vitality or growth of the organisms, while it injures the surface of the wound, and may be the very means of enabling bacteria to spread into the body.

Where we have to do with lacerated or contused wounds, the principles of treatment are essentially the same, but here we must be still more careful in our disinfection, because, in the first place, the wound is irregular, and it is very easy to overlook recesses in it; and, in the second place, the vitality of the surface of the wound is much more interfered with, and, if organisms have entered it, they very readily grow and penetrate into the tissues. In these cases special care must be taken to scrub away all the dirt and septic material which may have got in, and I think in most instances, in the case of lacerated wounds, it is well to employ the undiluted carbolic acid. Of course, in these wounds, stitches cannot be used unless where large portions of skin are detached and where it is desired simply to hold them in position, and union by first intention naturally cannot be expected. Where the disinfection has been satisfactorily accomplished, these wounds fill up with blood clot, and the material in the cavity is composed of torn portions of tissue mixed with this blood clot, and the subsequent mode of healing of the wound, provided the precautions described under Healing by Blood-clot (page 70 *et seq.*) are carried out with regard to the avoidance of mechanical or chemical irritation, will be that of healing by blood clot. It thus not uncommonly happens that

portions of tissue which, were the wound to become septic, would inevitably slough, remain undisturbed, and either become replaced by new tissue in the same manner as the blood clot is replaced, or may regain their vitality as skin grafts do. Where the attempt to render these wounds aseptic fails, irrigation is probably the best method of treatment in the case of lacerated wounds if they are extensive, the method being carried out as has already been described (page 67 *et seq.*).

The peculiar danger of these wounds not made by the surgeon depends very much on the extent of the injury, and more especially on the seat of the injury, and I may say one or two words with regard to accidental wounds in reference to their situation. In the first place, compound fractures were the earliest wounds in the treatment of which antiseptic methods were employed, and, in Sir Joseph Lister's first experiments, the treatment was to fill these wounds with undiluted carbolic acid, which became mixed with the blood and formed a sort of paste, and in these cases great success was obtained. Where we have to do with a compound fracture, it is very essential that no effort should be spared to secure the asepsis of the wound, and for that reason the patient should be anæsthetised and the part thoroughly exposed, the wound being enlarged as much as is necessary. I believe that in most instances of

compound fracture it is best to sponge the whole of the exposed surface of the tissues, both bone and soft tissues, with undiluted carbolic acid. This method is much more certain than the injection of the weaker solutions, and, as was shown by Sir Joseph Lister's earlier work, and as is now our experience, it does not complicate the subsequent healing of the wound, seeing that union by first intention is not aimed at.

Where the injury is an extensive one, and where it may not be advisable to lay the part so thoroughly open as is requisite in order to sponge the whole surface with undiluted carbolic acid, one may thoroughly irrigate the deeper parts of the wound with 1 to 20 carbolic lotion, employing for this purpose a catheter, which is pushed up into all the recesses of the wound, care being taken at the same time that there is free exit for the solution injected. But even in these cases I would certainly advise that the ends of the bones, at any rate, be sponged with the undiluted carbolic acid. Where this method of treatment is employed many limbs, which would otherwise be sacrificed, recover completely, and the rules which are found in text-books —especially in the older text-books—with regard to amputation after lacerated and contused wounds, especially with compound fractures, must be very much modified. Indeed, in cases of compound fracture, it is

practically never necessary to amputate primarily, unless, indeed, the limb is torn off, or unless the great vessels and nerves are so injured that the part beneath must die or be rendered absolutely useless. As regards the destruction of the skin, while formerly it was held that even although the bones and the nerves and the vessels were intact, if the skin of the extremity was very extensively destroyed, amputation was necessary, seeing that healing either would not occur or, if it did occur, would be accompanied by such deformity as to render the part useless, yet, at the present time, especially with the aid of skin grafting, even very extensive losses of skin need not necessitate immediate amputation. In such cases, after granulation has thoroughly taken place over the whole surface, the application of skin grafts by Thiersch's method will generally lead to a satisfactory result, and if it does not, amputation can always be performed at a later period.

Wounds penetrating the joints or the great cavities of the body are also less serious now than formerly if only they can be rendered aseptic. As regards wounds into joints it is especially necessary to be very thorough in the disinfection of the part, and when it is evident that the joint has been opened, the wound must be thoroughly laid open, and all recesses of the joints

cleansed with 1 to 20 carbolic solution, or even, if much dirt has been introduced, with undiluted carbolic acid. The freshly incised parts may then be stitched up, and drainage tubes introduced at various points so as to ensure free exit of the discharge. Once it is evident that the attempt at purification has succeeded, these tubes may be left out, and a more rapid healing of the wound obtained. In the case of joints where sepsis occurs in spite of the attempt at purification, it still does not become immediately necessary in most cases to amputate the part. The great point is to see that the drainage is very thorough, and if the symptoms are acute, probably irrigation with a mild antiseptic solution is the best treatment in the first instance.

The treatment of penetrating wounds of the abdomen will vary according to the injury inflicted on the contents, and also according to whether or not the viscera protrude through the wound. If the asepsis of the part cannot be very thoroughly carried out the wound itself should be held open and sponged, but I would not advise irrigation of the peritoneal cavity with any strong antiseptic solution. In the case of the peritoneum, as I have already remarked, sepsis is not so likely to occur as in the soft parts on account of the great power which the peritoneal cavity has of destroying the organisms which may enter it under certain conditions.

Of course, apart from the question of the actual treatment of the wound, it is now an axiom in surgery that if one has to do with a penetrating wound of the abdomen, the wound must be enlarged and the condition of the viscera thoroughly explored, more especially with the view of ascertaining whether any of the intestinal coils have been injured, and should such injury be found, the treatment adapted to the case must be employed, treatment which it would lead us too far in the present work to consider. Where the viscera protrude from the wound they may quite safely be thoroughly sponged with 1 to 2000 bichloride solution, or even with 1 to 40 carbolic acid, and having been thoroughly cleansed, should be returned to the abdominal cavity, provided no injury has been done to them. The question whether the wound in the abdominal wall should be stitched up, or whether drainage should be provided for, is a difficult one, and will depend on the circumstances of the case. Where there has been no injury to the intestinal walls, and where there is no reason to suppose that any gross particles of dirt have been introduced with the instruments, I think it is best to stitch up the wound completely; but where injury has been done to the intestinal wall, or where there is a suspicion that portions of clothing for example have been carried in which have not been found, it may be best to leave a

drainage tube in the wound communicating with the peritoneal cavity for two or three days. These are points, however, which I do not propose to enter into.

Wounds penetrating the thoracic cavity are much more difficult to treat. If the lungs protrude through the wound, as occasionally happens, the exposed part may be sponged and returned, the wound itself being thoroughly disinfected, and in some cases the external wound may be closed; but where the wound is ragged and dirty, and especially where portions of clothing have been carried in, it is best to put in a drainage tube, and possibly to make a counter-opening at the lowest part of the cavity, because suppuration will almost certainly occur. The drainage tube should be covered with a piece of protective, as will be mentioned in speaking of empyema, so as to valve the opening in order that fresh air may not be introduced, and that the air which has already entered may be absorbed, and then if suppuration does not occur, these tubes can be removed in a few days, the wound will heal rapidly, and the lungs will again expand.

In compound fractures of the skull it is almost always best to trephine at once instead of waiting for symptoms, because it is almost impossible thoroughly to disinfect the wound. The removal of the fractured surfaces of the bone does no harm, and enables one to

get rid of the septic material, while one may again introduce chips taken from the part of the bone away from the fractured edge, and thus more or less completely fill up the space left by the trephining. Scalp wounds, apart from compound fractures, should never be closely stitched up, but drainage should always be provided for a day or two, the wound being, of course, thoroughly disinfected in the usual manner.

I need not refer to wounds affecting other structures, such as tendons and nerves, where, of course, the divided parts should be at once brought together. What I have already said will be sufficient as exemplifying the method of treatment in different cases.

In the case of burns, we must also see that the surface is aseptic. Where the burn has gone on to the extent of producing charring of the skin, the slough is, of course, in the first instance free from organisms, and and if the surface of the slough is thoroughly washed with, say 1 to 20 carbolic acid, and the ordinary cyanide gauze dressing is applied, sepsis will be avoided. I believe the best dressing for burns which have led to complete destruction of the skin is the cyanide dressing, used after purification of the part with carbolic acid. Where the burn has only gone to the second or third degree, then, apparently, antiseptic ointments of various kinds are the best, and perhaps

the most suitable is the eucalyptus ointment, which, in the first instance, should be employed of the full pharmacopœial strength, namely, 1 to 5, and can be subsequently diluted if necessary. It will be found that in the case of burns treated antiseptically, only a comparatively small portion of the dead skin may separate, the rest acting like the blood clot as a mould into which cells penetrate, and which becomes covered with epithelium spreading from the adjacent surface. Where, however, large portions of slough have separated and a granulating surface is left, skin grafting should be employed at an early period, because otherwise the very greatest deformities are produced, apparently greater after burns than after simple lacerated wounds. This is probably due to the slower healing of the part, and to the excessive production of granulations, leading to excessive subsequent contraction.

WOUNDS WHICH HAVE NOT BEEN MADE BY THE SURGEON, AND IN WHICH SEVERAL DAYS AT LEAST HAVE ELAPSED FROM THE TIME OF THEIR INFLICTION.

We may divide wounds of this class into ordinary, open, granulating wounds, or still older wounds, which present the form of sinus or fistula. These

open wounds are practically to all intents and purposes to be treated in the manner described under ulcers, and unless extensive, or involving some important structure, or on the leg or foot, they generally heal fairly readily. Where it is important to obtain immediate asepsis of the part, as, for instance, in the case of wounds in the palm of the hand close to or involving the tendon sheaths, compound fracture, &c., the only certain method of disinfection is to scrape away the granulation tissue from the surface of the wound, and, when the bleeding has come to a standstill, sponge it over with undiluted carbolic acid. Sir Joseph Lister often employs for this purpose a strong solution of chloride of zinc, 40 grains to the ounce of water, but I do not think that this is at all so effectual as the method which I have mentioned. Where it is undesirable to administer an anæsthetic for the purpose, disinfection may be obtained by stuffing the wound with lint or gauze soaked in strong carbolic oil, 1 to 5. This stuffing is changed night and morning, the surrounding skin being washed with 1 to 20 carbolic acid solution. The wound will very soon assume a healthy appearance and lose its foul character, and then a less irritating dressing is employed. In cases where complete and early disinfection is not so essential, probably the use of iodoform is a more suitable method of treatment, and

where the wounds are superficial, the employment of weak boracic or eucalyptus ointment with boracic lint outside, answers very well.

Sinuses may be of two kinds—(*a*) simple sinuses, in which there is no specific virus present; and (*b*) those depending on a special virus, which, in the great majority of cases, is of a tubercular nature.

As regards simple sinus, various things may tend to interfere with the complete healing of the wound; for example, movement of the part. Where the wound has penetrated among muscles, the continued action of these muscles may interfere with the complete closure of the wound. Again, early contraction of the external orifice may lead to continued accumulation of fluid in the deeper part, which distends the wound, sets up irritation, and prevents its closure for a long time. This is, of course, especially the case where suppuration is taking place, and in such instances it will often be found that rapid healing will occur if the external wound is freely opened and proper drainage established. Then, again, a simple sinus will not heal on account of some foreign body being present, such as a piece of dead bone, a piece of sponge, septic ligature, &c., and till this foreign body has been removed either by nature or by the surgeon, healing will not occur. The treatment, of

course, in such instances depends in the first place on the cause which leads to the continuance of the sinus; for example, putting the part at absolute rest, so as to stop the movement of the muscles; free dilatation of the canal and proper drainage, where imperfect evacuation of discharge is the cause; removal of foreign bodies, &c. I do not think that it is advisable to inject these sinuses as is so frequently done, for the reason which I have previously mentioned as contra-indicating injections into wounds. As regards the dressing to be applied to the orifice of the sinus in these cases, if the wound is aseptic, of course the ordinary gauze dressing should be used; where the wound is septic, this is probably an unnecessary expense, and the various ointments, especially the strong boracic ointment, with boracic lint outside, will form a perfectly satisfactory dressing.

In other cases, the cause of the continuance of the sinus is the presence of some specific disease, more especially the presence of tubercular disease of the wall. In such cases the whole track of the sinus is composed of tubercular material which undergoes caseation, and has only a very slight tendency to heal. The treatment of a tubercular sinus will depend entirely on the condition of the patient. Very often these tubercular sinuses lead to foci of tubercular disease in bones, joints, glands,

&c., and the healing of the sinus is prevented not only by the tubercular condition of its walls, but also by the disease which is going on at the deeper part. The treatment of these sinuses consists essentially in complete removal of all the tubercular material; that is to say, the sinus itself should be cut out where that is anatomically possible, and the part from which it takes its origin, as, for example, carious bone or caseating glands, should also be removed. If that is done, a clean cut surface is left behind which readily heals. Where it is not possible to excise the sinus along with the bone or gland disease, if any, which may be present, the next best thing to do is to lay it as freely open as possible, and with a sharp spoon to scrape away the lining membrane and all disease which can be reached, and then, instead of introducing a drainage tube and dressing the external wound as was formerly done, it is, I believe, best to leave the wound open, and stuff it with gauze which has been dusted with iodoform. Where the wound is septic, or where it is known that tubercular material is left behind, it is, I think, advisable, as soon as the bleeding has stopped, to sponge the interior with undiluted carbolic acid. This method of stuffing the wound with iodoformed gauze seems to act very much better than any other plan short of complete removal of the tubercular disease. The gauze is mechanically

irritating, and leads to more or less luxuriant growth of granulations, while the iodoform may possibly have some anti-tubercular action. It has been supposed that iodoform acts better where oxygen is not present, and that, when injected into tubercular abscesses, it has a definite anti-bacteric action which is much favoured by the fact that it is in a closed cavity; and the reason, therefore, that it has been so much advocated for the stuffing of wounds of this kind is that it is assumed that, in the deeper part of the wound so stuffed, oxygen will be absent and the iodoform may thus exert its action. However this may be, I am quite satisfied that the results obtained by stuffing in this way are very much superior to those obtained by injecting iodoform and glycerine into these wounds, as I used formerly to do.

Fistula, as I have said, is a condition where there is an opening in the skin and an opening in the mucous membrane with a canal between them. It occurs in various parts of the body, especially around the orifices of the mucous canals. Thus we have salivary fistula where there is an external opening into a salivary duct, this duct leading again into the mouth; intestinal fistulæ, where there is a communication between the intestinal canal and the surface of the skin, resulting from disease or injury, as after gangrenous hernia,

colotomy, &c.; anal fistulæ, where an abscess forms under the mucous membrane of the rectum, and finds its way into the ischio-rectal fossa, opening both externally and internally; perineal fistulæ, where there is a communication between the urethra and the perineum; congenital fistulæ in the neck, which are the remains of the branchial clefts, or in connection with the intestine, the result of a congenital malformation, &c. The chief reason why these fistulæ do not heal is the constant passage of saliva, fæces, urine, &c., through them, and, in addition, in the case of congenital fistulæ, the fact that the whole canal is lined with epithelium. The treatment of the various fistulæ can hardly be considered here, depending as it does on various local conditions which would require full consideration; but the treatment consists essentially in preventing the flow of foreign materials along the track, and bringing the surface of the fistula into a healthy condition. In the case of salivary fistula a more direct opening is made into the mouth for the saliva, and the external opening pared and stitched up. Similarly, in the case of intestinal fistulæ means are taken to make it more easy for the fæcal matter to pass along the intestinal tract than to make its way out through the fistulous opening. Thus, where fæcal fistulæ has resulted from gangrene after strangulated hernia, the contents of the

upper part of the bowel cannot find their way into the lower part, on account of the spur of the mucous membrane which valves the orifice and the lower part of the canal, and steps must be taken to remove this obstruction, either on the principle of Dupuytren's enterotome, or by resection of the ends of the bowel and immediate union. In the case of an anal fistula the only satisfactory method is to lay it freely open, scrape or cut away the wall of the fistula, especially if it is tubercular, and then stuff the wound for some days, and make it heal from the bottom. In the case of perineal fistula, by curing the stricture one often gets healing of the fistula without further treatment. Where we have to do with congenital fistulæ nothing short of complete removal of the whole track by dissection will effect a cure; attempts at destroying the mucous lining of the canal by scraping or caustics usually fail, probably because islets of epithelium are left behind.

WOUNDS WHICH INVOLVE NOT ONLY THE SKIN, BUT ALSO THE MUCOUS MEMBRANE, OR IN WHICH SEPTIC CAVITIES WHICH CANNOT BE DISINFECTED ARE OPENED UP.

In these cases, strict asepsis cannot be obtained, because in the case of a wound, say in the mouth, it is impossible to exclude the bacteria which are everywhere present in the fluids, and therefore the problem in such instances is not to exclude bacteria from the wounds, but to diminish their action in every way possible. In the first place, the vitality of the tissues must be interfered with to as slight a degree as possible during the operation, the manipulations being gentle, and pinching and rough treatment of the wound being avoided. Further, wherever it can be managed, union by first intention should be aimed at, and in order to obtain that the bleeding must be very thoroughly arrested, care must be taken that no foreign material whatever is left between the edges, and care must also be taken that the whole cut surface of the wound, and not merely the mucous surface, is in accurate and close apposition.

In bringing these wounds together stitches must be

employed which are not themselves porous, and will not therefore form a nidus for the growth of bacteria. Silk is consequently out of the question. Probably the best stitches, where they are strong enough, are those of horse hair, which, like silver wire or silkworm-gut, does not become soaked with fluids, and which, therefore, does not, like silk, become a putrid foreign body. Where stronger material is required, silkworm-gut in most cases will answer all purposes, and it is less rigid and consequently less disagreeable to the patient than silver wire.

No dressing is of course possible in these cases, but frequent washing of the surface with antiseptic solutions should be carried out. For example, in operations about the mouth, it is well to provide the patient with a quantity of some weak antiseptic solution, such as sanitas or weak Condy's fluid, and to instruct him to rinse out his mouth—or to gargle, if the incision is far back—at repeated intervals.

In cases where the edges of the wound cannot be brought together, and where, therefore, healing must take place by granulation, it is of great importance to avoid, if possible, septic decomposition of the surface of the wound during the first two or three days. After that time there is usually such a marked invasion of cells in the deeper part of the wound, that bacteria find

considerable difficulty in entering; indeed, the chief bacteria which are able to penetrate under such circumstances are either the streptococci, giving rise to creeping, diffuse cellulitis, or such organisms as the diphtheritic bacilli, which settle on the wound and grow in the superficial tissues. For this purpose Sir Joseph Lister has, for many years, employed a solution of chloride of zinc, 40 grains to the ounce, and he regards it as, so to speak, pickling the surface of the wound for a day or two after it has been made. It is certainly a fact that after a thorough application of chloride of zinc to a cut surface exposed to the elements of putrefaction, decomposition does not apparently occur so early as where the wound is abandoned to nature, and therefore this method is one which may be strongly recommended. In some cases I have employed instead undiluted carbolic acid, and I think that with it the results are probably equally good, while the after-pain is distinctly less. It is especially in these cases that iodoform is of value, and it is well after having sponged the cut surface with chloride of zinc or undiluted carbolic acid, to powder it thoroughly with iodoform crystals, and to repeat the application once or twice daily as these crystals are washed away by the discharge. Once the wound is granulating, mild antiseptic washes are in most cases all that is necessary;

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TREATMENT OF ULCERS.

TREATMENT OF ULCERS.

AN ulcer may, in the first instance, be roughly defined as any breach of the surface of the skin or mucous membrane which does not heal. This definition includes not merely ulcers proper—that is to say, an inflammatory process—but also ulcerative processes occurring in tumours. True ulceration is an inflammatory process, and a more accurate definition of an ulcer is an extending loss of substance in the skin or mucous membrane in a part which has been previously the seat of inflammatory changes which have gone on to granulation, this continued loss of substance being due not to death of visible pieces of tissue, but to degeneration of the cells or death of microscopic portions of tissue,—what is spoken of as molecular death.

Of ulcers proper we have two great classes:—(i.) those which are not due to any specific virus, but which are caused by various local troubles, such as alterations in the circulation or innervation of the part, which I

shall immediately allude to. This class may be spoken of as the chronic non-infective ulcer. There is, however, a second large group of ulcers, where a specific virus is at the root of the ulcerative process, by far the largest number of these ulcers being the result of syphilitic or tuberculous disease. In these cases there is, preceding the ulcerative process, a formation of new tissue which has a special tendency to degeneration, either syphilitic gummatous tissue or tubercles which undergo caseation, and the ulcerative process is the result of the degenerative changes which take place in this new tissue.

The Chronic Non-infective Ulcers.

Before proceeding to the consideration of the treatment of these ulcers, we must, in the first instance, make ourselves familiar with the various causes which lead to the ulcerative process. These causes are mainly local, and among the chief of them are those which tend to interfere with the normal circulation of blood in the part. For example, in the dependent position of the part there is a certain difficulty to the return of blood and consequently an imperfect nutrition in the inflamed tissues, and hence it is that the great majority of

ulcers affect the lower extremity, even when no disease of blood vessels interferes with the circulation. A patient who has a granulating wound on the leg is very apt to become the subject of an ulcerative process if he continues to stand, or walk about much on the leg or even to hang it down.

Perhaps one of the most frequent causes of these ulcers is the presence of varicose veins, more especially where the veins which are varicose are the small vessels in the skin. Under such circumstances there is a very marked obstacle to the return of the blood, and consequently great stagnation of blood in the part. Then again, the presence of atheroma of the arteries will act similarly in that there will be a smaller quantity of blood brought to the part; and if, in addition to the presence of this disease of the arteries, the dependent position is superadded, the ulcerative process may go on rapidly. Where the inflammatory process has led to a considerable amount of exudation into the tissues around, this exudation presses on the blood vessels leading to the surface of the sore, and interferes with the supply or the return of blood in the part. This is more especially the case where the sore is situated over loose connective tissue, the meshes of which very readily become distended with lymph, and which is but sparely supplied with blood vessels.

In addition to these causes depending on defects in the circulation, ulceration is greatly favoured by a weak condition of the tissues, more especially as the result of old age. A wound on the leg in a young patient, even although he may have varicose veins, and although he continues to walk about, is not nearly so likely to lead to an ulcer as a similar injury in an old person; and this is to a large extent owing to the greater vitality and recuperative power of the tissues in the young. A similar result is brought about by severe and continued cold, which, short of producing gangrene, causes the formation of chilblains, and subsequently it may be of ulcers. Another local cause which leads to ulceration is movement of the part. For example, where a sore is situated immediately over a muscle, and more especially when it is adhering to it, or where it is situated over a fascia which is in frequent movement, that sore is much more likely to ulcerate as a result of the movement of the muscles beneath than a sore which is situated elsewhere. Again, where a sore cannot contract, the ulcerative process is very apt to be set up. As I have previously said in speaking of healing by granulation, a considerable share in the healing process is taken by the contraction of the newly-formed fibrous tissue, and if this contraction cannot occur and the sore is large, a time will come when healing will cease and ulceration

take place. The constant effort of the new fibrous tissue to contract without success seems to irritate the part and arrest the healing. This inability to contract may simply result from the great size of the sore, as, for instance, after burns, where the greater part may heal, but a portion in the centre may refuse to heal and subsequently ulcerate. Here contraction goes on till at length no further contraction is possible, and then healing ceases.

In such cases, no doubt, there is another fact which must be taken into consideration, viz., that as the result of the contraction of all the marginal and deeper parts of the sore, the blood vessels leading to the centre become compressed and the circulation is rendered imperfect; but, nevertheless, apart from interference with the circulation the contraction of the sore itself seems sufficient to put a stop to the healing process. Another case in which contraction cannot occur is where a sore is situated over and adherent to a bone. In that case, also, if the sore is of considerable size, not only will healing not occur, but after a time ulceration will take place, especially if the parts around become œdematous, and the circulation is thus interfered with.

Again, irritation of the sore will lead to its conversion into an ulcer,—irritation, for example, by mechanical

action, as by pressure too long continued, by rubbing of dressings, &c., or from the presence of certain chemical substances, such as carbolic acid, which is often and very wrongly applied to ulcers, or decomposing secretions, more especially where the secretions have partially dried and formed crusts over the surface of the wound underneath which the decomposing and irritating pus is retained. In wounds secreting septic pus, and which are healing, it is not uncommon to find, after a crust is allowed to form on the surface, that on peeling it off not only has the healing process come to a standstill, but actual ulceration is taking place beneath.

Then, again, the ulcerative process may be set up by accidental contamination of the wound, leading to too violent inflammation of the part, or by some specific infection of the wound, more especially diphtheritic or phagedænic infection. Lastly, we have ulcers occurring in parts in which the innervation is deficient,—for example, after paralysis, this being due in part, no doubt, to the fact that, accompanying the loss of sensation, the patient is very apt to press unduly on some one spot, and thus lead to inflammation and ulceration, but in part also to a distinct interference with the nutrition of the tissue and trophic changes as the result of the loss of the nervous supply. Ulcers also occur in

connection with certain constitutional conditions, such as diabetes, scurvy, &c.

The proper treatment of ulcers and their rapid cure are matters of great importance, because a patient who is afflicted with an ulcer of the leg is not only more or less incapacitated from his work, but is liable to various accidents which may render him a permanent cripple, or even lead to the loss of his life. For example, where we have an ulcer on the leg, especially over the muscular part of the leg, the muscles beneath are very apt to become inflamed and infiltrated with exudation, and so to lose their function, and the patient may be crippled from his inability to move these muscles properly. The same may be the case where the ulcer is situated over the tendons, where adhesion takes place between the tendons and the tendon sheaths, or between the tendons and other structures in the immediate neighbourhood, leading to loss of action of the muscle. Perhaps the most common disability resulting from the presence of the ulceration is the result of the contraction which goes on in the efforts at healing. Where an ulcer is situated over a joint, for example, during the healing process so much contraction may take place as to completely flex the joint and interfere with its further mobility. Or, again, where we have an ulcer completely surrounding the leg,

if it should heal, the contraction is apt to be so great as to constrict the vessels leading to the part below, and thus cause great œdema and often complete uselessness of the foot. A further risk of an ulcer is that the veins in the neighbourhood are apt to become inflamed, and that there may be an extensive, simple, or septic phlebitis leading from the part, and this is more likely to occur where the veins are varicose. Further, the patient is subject to all the ordinary septic diseases, more especially to the occurrence of erysipelas, which may prove very serious. Again, I may mention that in cases where ulcers last a long time, it not uncommonly happens that an epithelioma develops at the margins, and the patient may die of this cancerous growth.

These chronic non-infective ulcers are divided into several classes, according to their appearance and tendencies, and I must shortly refer to the chief groups.

(1.) The *Simple Ulcer*.—These are sores which are kept from healing by various local causes, such as pressure, friction, muscular movements, inability to contract, either from their great size or from their situation, &c. In these simple ulcers the surface of the sore is nearly on a level with the surrounding skin; it is covered with yellowish or brownish red granula-

tions, the margins are sharp, and the surroundings are œdematous and firm. These sores are generally situated about the middle of the lower third of the leg, and they may extend fairly rapidly where no proper care is taken. In certain cases these and other ulcers may become the seat of an acute inflammation, and we have—

(2.) The *Inflamed Ulcer.*—This is an ulcer which has become the seat of acute inflammation, as the result of some mechanical or chemical irritation, bad methods of treatment, and so forth. In these cases the surface of the ulcer becomes intensely red, bleeds readily, secretes large quantities of pus, extends with great rapidity, and is not unfrequently covered with little pieces of actual gangrenous tissue. The skin around is also bright red and œdematous, and the borders are irregular and eaten away, and it is not uncommon for fresh ulcers to develop rapidly around the margins of the original sore. These ulcers are generally acutely painful.

(3.) *Irritable Ulcer.*—This form of ulcer is one which occurs especially in neurotic women. It is generally in the form of a small sore with a somewhat elevated surface, and is intensely tender to the slightest touch. It is usually associated with menstrual disorders. It usually occurs above the external malleolus.

(4.) *Weak Ulcers.*—The simple ulcer, or the healing sore, is very apt to become a weak ulcer as the result of defective blood supply, either from too small a quantity of blood being sent to the part, as in cases where the vessels are diseased, or from deficient quality of the blood, for example, during the progress of some constitutional disease. In this form of ulcer the granulations become smooth and somewhat yellowish, the secretion thin and small in amount, and very apt to scab, and the edges pale and flat. In other cases of weak ulcer the granulations become œdematous, and this is more especially the case where there is some general cause of œdema, or some local interference with the circulation, such as the presence of varicose veins, compression of veins from the contraction of the sore, &c. Or again, we have another form of the weak ulcer,—where the granulations show excessive growth. This is chiefly the case where the ulceration is due to inability of the sore to contract. In such cases the granulations become prominent, vascular, soft, and bleed readily, and we have the condition which is popularly spoken of as "proud flesh."

(5.) These simple ulcers again may become attacked with some specific septic virus, more especially with the diphtheritic virus, or the other virus, the nature of which is not exactly known, and which leads to what

is called the *Phagedœnic Ulcer.* In the latter case, the ulcer becomes covered with a greyish pulpy material, which rapidly infiltrates the surrounding skin and cellular tissue, and extends both superficially and deeply at the bottom of the sore, leading to extensive and very rapid destruction of the part, and not uncommonly to the death of the patient.

(6.) The *Varicose Ulcer*.—This is a form of ulcer which originates as the result of varicose veins. As a rule, if only the larger veins are varicose, ulceration is not so apt to occur; but where, in addition to the varicosity of the large veins, the smaller venules in the skin are affected, ulceration is not unlikely to take place, especially in old people. This condition of varicosity of the smaller veins leads to imperfect nutrition of the skin, to the formation of an excessive amount of epidermis, and ultimately to a local dermatitis. This dermatitis goes on to eczema, and we have the condition known as varicose eczema. The patient then scratches the eczematous part, and produces a wound, which becomes inflamed, and, if the patient continues to walk about, rapidly develops into an ulcer. In other cases inflammation occurs around a varicose vein (periphlebitis), and an abscess forms, which bursts. A little sore is thus produced, which extends by ulceration. However produced, these varicose ulcers are usually in the first

instance small and superficial ulcers, with œdema around, and sometimes prominent, soft, or perhaps œdematous granulations. If the patient continues to walk about with a varicose ulcer, the condition gradually passes into that of—

(7.) The *Callous Ulcer.*—As the result of the continued interference with the venous return, œdema of the part takes place, exudation of coagulable lymph goes on into the interstices of the cellular tissue, which thus become much distended, with the result that the arterioles are pressed upon, and the nutrition of the sore is much interfered with. This exuded material coagulates, and to a considerable extent becomes organised; the result is that the skin and subcutaneous tissues around the ulcer become very much thickened, so that the surface of the ulcer comes to lie at a considerably lower level than its edges, and at first sight it looks as if the ulceration had extended in depth, and ultimately the callous condition is produced; the characteristics of the callous ulcer being a sore at a deeper level than the surrounding skin, the surrounding parts hard and firm, the surface of the sore devoid of granulations, pale yellow, and secreting only a small quantity of thin fluid.

(8.) Then again, in certain cases we have what is known as the *Hæmorrhagic Ulcer*, occurring more

especially in patients suffering from scurvy, where we have an ulcer which bleeds readily, the surface of the sore being swollen and red, and the blood sometimes coagulating on the surface, and forming a projecting clot.

(9.) *Ulcers as the result of pressure.*—These especially occur on the sole of the foot, and they result from long-continued, but not necessarily severe, pressure. In the first instance, this pressure leads to thickening of the epidermis and the formation of a callosity. Underneath this callosity inflammation and suppuration occurs, and when the thickened epidermis is separated, an ulcer is seen, the character of which is a deep sore, with great thickening of the epidermis around the sides.

(10.) Lastly, we have the ulcers which occur in connection with deficient innervation. In limbs which are paralysed, it is not uncommon to find atonic ulcers, which are painless, sometimes multiple, and quite superficial, as a rule with very imperfect granulations on the surface. These ulcers especially occur about the phalanges of the fingers and toes; they also occur on the sole of the foot, but in this place they are generally ascribed to pressure, and assume the form which is described under the head of pressure ulcers. In connection with these pressure and paralytic ulcers, I may specially mention—

(11.) The *Perforating Ulcer* of the foot, which occurs at the parts of the foot where there is marked pressure, more especially under the heads of the metatarsal bones, chiefly of the great toe. These perforating ulcers generally attack men over forty, who are always working, and they are not necessarily associated with any paralytic condition of the limb, but they are supposed to result more especially from a peripheral neuritis. This perforating ulcer begins as a callosity, with inflammation beneath, and the formation of an ulcer resembling in all respects a pressure ulcer in the first instance. This ulcer then extends in depth, becoming funnel-shaped, and may penetrate as far as the bone. The bone may become the seat of rarefying osteitis, and may completely disappear at that part; the base of the ulcer is generally covered with reddish, warty granulations, and the secretion is of a very foul character. The cavity of the ulcer is filled up with dense masses of epidermis, the epithelium having spread down the sides of the ulcer, and there being great proliferation of the epidermis. It is most likely that these perforating ulcers are in the main pressure ulcers, starting in the first instance like the ordinary pressure ulcer, with the formation of a callosity. The pressure is kept up by the epidermic growth down the sides of the ulcer, which forms a hardish mass and presses on the deeper

parts. At the same time, it must be acknowledged that the exact pathology is not thoroughly made out. Whatever the pathology may be, these cases are very chronic, and they will not heal even although the patient is kept in bed for a long time; the reason why they do not heal being the presence of this growth of epidermis down the sides of the ulcer, which prevents the adhesion of the sides to one another.

(12.) In certain constitutional states, such as diabetes, ulcers may form. In diabetes, inflammation and ulceration may follow a slight scratch or cut, and the characters of a diabetic ulcer are its rapid spread, the presence of considerable inflammation around, and often of sloughs of tissue. The rapidity of spread and the inflammatory changes arise especially in connection with the endarteritis, which occurs in diabetics, and the special liability of the tissues to septic infection.

TREATMENT.

The conditions which are necessary for the healing of ulcers are the same as those which are necessary in the case of wounds. As I have previously mentioned, in speaking of granulating wounds, the chief essentials are that the surface of the sore must become level with

the surrounding parts, that the margins of the sore must be movable in order to permit its contraction, and that the granulations on the surface must be healthy. We have three principles to attend to in the treatment of ulcers, namely—(i.) to get rid of the various causes which are keeping up the ulceration, the most important of which I have already mentioned; (ii.) to improve the condition of the surface and the margins of the ulcer; and (iii.) to further healing in any other way possible.

The first essential in the treatment of all ulcers is rest. As I have already said, any movement of the part will tend to keep up the ulceration, consequently the patient must be absolutely prohibited, if it is desired to get the ulcer to heal quickly, from walking about, and the movement of the neighbouring joints must also be prevented by the application of splints which control and fix them in the proper positions. In the case, for example, of ulcers in the leg—the most frequent seat—it is well to apply one or two lateral splints grasping the leg and the knee, and fixing the ankle-joint and keeping the foot at right angles to the leg.

The second principle, which is of the greatest importance in the treatment of ulcers, is to favour the return circulation. I have already referred to the great importance of the interference with the return cir-

culation in the formation of ulcers, as a primary cause—for example, in the occurrence of simple ulcers or varicose ulcers—and as a secondary cause leading to the formation of a callous ulcer; and so long as provision is not made for the proper return of the blood from the part, so long will the ulcer refuse to heal. This may be brought about in various ways, but the most efficient of all is to place the part at a higher level than the heart; and in the case of ulcers of the leg, to place the patient in bed and elevate the leg on a pillow. Even in a bad case of callous ulcer, without any further treatment, the œdema of the leg will very soon begin to go down under this treatment, and coincidently with that, the surface of the sore will become covered with granulations, and in the course of two or three weeks will begin to heal at the edge. This is a result which is not obtainable so rapidly by any other method of treatment where the vertical position is permitted.

The return of the blood and lymph from the part may also be favoured by massage, but that also should be combined with rest in the elevated position. Where massage is employed, the kneading should begin at the upper part above the ulcer, and by and bye, as the skin gets softer in that region, the area which is subjected to treatment is increased downwards. Other ways in which the return circulation is favoured—for

example by pressure, will be spoken of when we come to discuss the question of the treatment of callous ulcer.

A third great point which is common to the treatment of all ulcers is to get rid of all causes of irritation of the surface of the sore. The substances which may cause irritation may act either mechanically or chemically; mechanically more especially in the form of dressings and bandages, or chemically chiefly in the form of sepsis. Of these the most important are the chemically disturbing causes. The presence of decomposing discharge on the surface of an ulcer will interfere very materially with the healing process; and it is, therefore, one of the most important points at the commencement of the treatment to remedy, as far as possible, the septic condition. In order to do this, the following is the best method of procedure. In the first place, the skin for a considerable area around the ulcer, should be thoroughly disinfected, because, of course, to disinfect the surface of the ulcer alone and leave the skin septic would simply mean that in the course of a few days the ulcer would again become foul. In the first instance, then, the skin around is thoroughly washed with soap and water, and all hairs are shaved off. It is then disinfected in the same way as the skin is disinfected before proceeding to an operation through unbroken skin, that is to say, after washing and shaving the skin,

turpentine is applied so as to dissolve the fat, and then the part is thoroughly scrubbed with a nail brush and the strong mixture of carbolic acid and sublimate, soap being employed with the view of removing the turpentine. As regards the surface of the ulcer, it is not always an easy matter to complete the disinfection at one sitting. Sir Joseph Lister's first method of disinfecting ulcers was to apply a solution of chloride of zinc, 40 grains to the ounce, thoroughly to the surface of the ulcer, repeating it in two or three days. If it is evident that the disinfection has not been successful, I believe that in the long run the most satisfactory results will be obtained by applying undiluted carbolic acid. As a matter of fact, the destruction of the superficial layer of granulations on the ulcer is a matter of absolutely no moment, because at the time that the treatment of the ulcer is taken in hand, these are generally unhealthy, and are best got rid of by this summary procedure. In fact, in cases where the granulations are at all exuberant, or the sore a "weak" one, I believe it is still better in the first instance to scrape them away, and then to apply the undiluted carbolic acid to the scraped surface.

Another method which may be employed, when it is not desirable to administer an anæsthetic, or to cause so much pain to the patient as would be produced by

chloride of zinc, or immediately on the application of carbolic acid, is to employ strong carbolic oil, 1 to 5. Lint dripping in 1 to 5 carbolic oil should be carefully packed into all the recesses of the ulcer, and if this dressing is changed every day, it will be found that in a few days the sepsis has been completely got rid of.

As to the use of iodoform in ulcers, it is, of course, inefficient as a means of disinfecting them completely, and only acts by diminishing the evil effect of the already existing sepsis. As, however, I consider it of very great importance at the initial stage in the treatment of an ulcer to obtain an aseptic surface, I think one does much better to employ either the undiluted carbolic acid or the carbolic oil in the first instance, in preference to iodoform. Usually for the first two or three days after the preliminary disinfection of the wound, I have applied the cyanide gauze directly to the surface of the ulcer, the gauze being soaked in 1 to 2000 bichloride of mercury solution, and having been only imperfectly squeezed, so that there is a considerable amount of solution actually kept in contact with the surface of the ulcer. In a few days, however, sepsis having been got rid of, we must adopt means to avoid any further irritation of the sore, either by the chemical antiseptics employed, or by the dressings, otherwise the sore would not heal, although it were aseptic, and although the limb were placed at

rest and in a suitable position. It is too often the custom to employ carbolic lotion and lint dipped in carbolic acid as a dressing for ulcers. This, as far as I have seen, is far too irritating a dressing, and will of itself interfere with the healing of the ulcer.

The method which Sir Joseph Lister employed, and which is still in most cases probably the best, is to use an absolutely non-irritating antiseptic, such as boracic acid, as the application to the wound, and to prevent the mechanical irritation of the dressing by interposing between it and the surface of the sore, a piece of the oiled silk protective. The method is, after having got rid of the sepsis completely, to take a piece of the oiled silk protective—which is oiled silk covered with a layer of dextrine, in order that the antiseptic solution in which it is placed may not run off the surface, but may wet it uniformly—slightly larger than the wound, and having first dipped it in 1 to 20 carbolic acid lotion in order to disinfect it, to place it in the saturated watery solution of boracic acid. This protective is then applied over the surface, care being taken that it shall overlap the edges in all directions, but shall not extend above a quarter to half an inch beyond them. Outside this, two or three layers of boracic lint which have been wrung out of the solution are applied over the protective and over a large area of the skin around, and fixed

on with a bandage. In cases where the surface of the sore is extensive, and where there is a good deal of secretion, it is well to clip a few holes in the protective, so as to prevent the discharge being confined beneath it; but in the case of a small sore, this is hardly necessary. This dressing is changed daily, the surface of the wound being washed with boracic lotion, and the surrounding skin with 1 to 20 carbolic lotion, care being taken that the carbolic lotion does not run over the wound; and, further, the skin around is shaved at least once a week so as to prevent the growth of the hairs, which would otherwise entangle the discharge in them, and tend to act as centres for bacteric growth.

In cases where the ulcers are painful, or where there are sloughs on the surface, it is well to employ the boracic lint wet, without any protective, the lint being used in the same way as a water dressing; that is to say, the boracic lint, soaked with boracic lotion, is applied over the ulcer and a little beyond it, and outside the boracic lint, overlapping it in all directions, is fixed a piece of mackintosh which has been disinfected in the carbolic lotion. This wet boracic dressing, or boracic poultice, as it is sometimes called, should be changed twice daily, and should not be continued after the irritable condition of the sore has ceased, or after the sloughs have separated. If this water dressing is too

long continued, the granulations are very apt to become œdematous, and one form of weak ulcer is thus established. On the other hand, where the granulations become œdematous, dry dressings—the boracic lint well wrung out of boracic lotion, without the interposition of any protective—are probably the best.

The other method of dressing ulcers is the use of various ointments, of which those chiefly employed are boracic ointment, eucalyptus ointment, or iodoform ointment. As a rule, I do not think that the wounds heal so kindly, when they are at all extensive, under ointments as they do under the protective and boracic lint dressing, and certainly they do not heal well under boracic ointment of the ordinary pharmacopœial strength. Where the wound is healing rapidly and boracic ointment is used, the pharmacopœial ointment should be diluted to about a half or a quarter of its strength, probably the best is about a quarter strength. The strong boracic ointment seems to interfere with the epithelial growth, and is therefore unsuitable in such cases. It acts, however, very well in the early stage of the treatment of ulcers, before epithelial growth has begun at the edges of the wound.

A fourth object in the treatment of ulcers, which is common to all, is that attempts should be made to get rapid healing with as little contraction as possible, and

to obtain a scar which shall subsequently be sound. In the case of ulcers affecting the lower extremity, especially in oldish people, the scar obtained, where an ulcer is allowed to heal of itself, is usually weak, and commonly breaks down again if the patient afterwards has much standing or walking, the result being that he has, every now and then, to give up his work in order to get the ulcer healed, or else to be content to employ means which only interfere with the extension of the ulcer and which relieve him of his discomfort

Where, however, a sound scar is desired, and where it is important to avoid any great contraction, it is necessary to employ the methods of skin grafting, and of these the best is that introduced by Thiersch. There are three plans in which the rapid epidermic covering of the sore may be brought about, the earliest being Reverdin's method, which, however, is more properly termed epidermic grafting than skin grafting. In his plan minute portions of the superficial layer of the skin are shaved off; pieces of about the size of a pin's head are then planted on the surface of the granulations at short distances from each other. The result is that epidermic growth occurs from each of these little points, and numerous little islets of epithelium are thus formed over the surface of the sore. If these grafts are close enough together, and the other condi-

tions of healing are favourable, these islets of epidermic growth soon coalesce, and in this way rapid cicatrisation of the sore is brought about. It is necessary in this method that the grafts should not be too far apart, because, as a rule, it seems that they have only a limited power of reproduction. Usually a minute graft the size of a pin's head will give rise to an islet of epidermis about the size of a sixpence, and then further growth seems to come to a standstill; therefore, in order to get rapid healing over the whole surface, the grafts should not be further apart than the diameter of a sixpence.

The result of this method of epidermis grafting is that rapid healing of a sore is obtained in many cases, more especially in burns and sores on the trunk, where contraction of the deeper part is readily possible, and no doubt the subsequent contraction is considerably diminished, because less granulation tissue is formed than if the sore has to heal altogether from the margin. Nevertheless, a considerable amount of contraction does occur in sores in which healing has been obtained in this way, and the resulting scar is in reality not materially stronger than the scar which is obtained by permitting the sore to heal from the edge.

With the view of obtaining a sounder scar, much more extensive and thicker portions of skin must be

taken, and they must be applied close together. There are two ways of doing this, either by using the whole thickness of the skin, or, still better, by employing Thiersch's method, in which about half the thickness of the skin is shaved off. Whichever of these plans is employed, the preliminary portions of the treatment are the same. The skin which is to be used as the grafts must, in the first instance, be thoroughly disinfected in the usual manner, and must also be carefully shaved; the presence of hairs in the grafts seems to materially interfere with the union.

The sore itself must also be prepared beforehand. In the first place, the ulcer must be got into a healthy condition, and this is best indicated by the occurrence of healing at the edges. As a rule, if one attempts to graft a sore which is still ulcerating, the graft will fail to take, and the result will be unsatisfactory; hence the first thing to do as a preparation for skin grafting is to act on the principles which I have already mentioned, and to wait till the surface of the sore has become covered with healthy granulations, and till the commencement of epithelial formation at the margin is evident. Some surgeons wait still longer, and the usual time given is about six weeks after the commencement of the treatment, and further, they prepare the surface of the sore in an elaborate manner with the

view of getting a firm, vascular basis of fibrous tissue; this is chiefly done by repeatedly cauterising the surface with nitrate of silver. I have not, however, found that this preliminary treatment of the sore is necessary, nor that it is desirable to wait longer than till the tissues have passed into a healthy state and healing has commenced.

Having got the sore into this condition one should make sure that it is aseptic, and then, the patient having been placed under chloroform, the granulations over the whole surface should be scraped away, taking care not to go through the deeper layer of newly formed fibrous tissue and into the fat. The result is that a surface which is quite smooth, highly vascular and firm is left, on which the grafts are laid, this surface consisting of the deeper layers of granulation tissue which have already become organised into new fibrous tissue. I consider it also of the very greatest importance in the case of ulcers of the leg to remove the portions of the sore which have already become covered with epithelium. One is tempted to limit the skin grafting to the actual unhealed portions of the sore, and, in the earlier cases in which I employed this method, I did so. The result was very disappointing, for while, if a patient walked about, the region which was skin grafted remained perfectly sound, the interval

between the skin grafts and the healthy skin, which had become covered by epidermic formation previous to the performance of the skin grafting operation, broke down. Thus, instead of a complete recurrence of the ulcer, a narrow line of ulceration was left surrounding the central area which had been skin grafted, this line of ulceration being extremely difficult to treat. That experience in several cases has led me to do as I have recommended above, namely, in all cases to cut away the whole healed part of the sore right on to the healthy skin so as to cover the whole surface with the skin grafts.

Having in this way prepared the surface of the sore, the bleeding must be completely arrested before the skin grafts are applied, and this is done by taking a large piece of protective, dipping it in 1 to 20 carbolic acid so as to disinfect it, and subsequently in weak sublimate solution or in boracic lotion, and applying it over the whole surface which has been scraped. Outside this sponges are placed on which an assistant keeps up pressure, or, if there is no assistant, a bandage is applied firmly over the part. The object of the protective, which was introduced by Halsted, of Baltimore, is to avoid the occurrence of the bleeding when the pressure is taken off. If the sponges or dressing are applied directly to the wound with the view of exer-

cising pressure, the bleeding for the time ceases, but the sponges or dressing become adherent to the surface of the wound, and, on pulling them off, the bleeding is reproduced. If, however, a piece of protective is interposed between the sponges or dressing and the surface of the sore, no adhesion takes place, and the pressure can be removed without starting the bleeding again.

While the bleeding is being arrested by pressure, the surgeon may proceed to cut his skin grafts. In Thiersch's method of skin grafting the grafts may be taken from any part of the body, but, as a rule, they are most conveniently cut from the extremities, and I most usually take them from the thighs. The skin having been prepared in the manner previously described, it is put vertically on the stretch by an assistant, and the surgeon grasps the thigh behind and makes the skin tense and prominent by pushing the muscles and skin forward from the bone, and in this way gets a more or less flat surface. The razor, which should have a broad blade, is dipped in boracic lotion or a very weak sublimate solution, and is kept constantly wet with this solution while the graft is being cut in the same way as a razor is kept wet in making microscopical sections of fresh tissues; if this is not done, the graft tends to adhere to the razor and, in a very short time. the base of the graft is cut through. The razor penetrates the

skin to about half its thickness, and then, by a sawing motion, the grafts are cut as broad and as long as possible. After a little practice one can cut grafts from 1 to 2 inches in breadth, and of the whole length of the thigh. I generally leave the graft lying on the slightly bleeding surface from which it has been taken till it is required for use. I think that is better than placing it in a warm antiseptic solution (boracic lotion) or a solution of salt and water; sufficient warmth is communicated from the limb, and the graft remains bathed in blood and serum.

One goes on cutting fresh grafts till enough have been obtained, and then, the bleeding having been arrested as formerly described, the graft is transferred bodily to the surface of the ulcer. If the graft is too long, it is cut across with fine scissors at the requisite point. These grafts should be applied quite in contact with each other,—in fact, the thin edges of the grafts should overlap each other, and they should also overlap the margin of the ulcer, so that when the process is completed the ulcer is entirely covered with pieces of skin, and one should not be able to see any part of the raw surface. While the grafts are being spread out in this way bubbles of air are apt to be caught under the deeper surface, and, at the same time, a little bleeding may occur; consequently it is neces-

sary, having arranged the grafts in the manner described over the whole surface of the wound, to apply pressure again in order to squeeze out the air and blood which may have accumulated underneath. I generally do this by taking a narrow strip of protective —which has been rendered aseptic as formerly described—and, holding it at each end, place it gently over the grafts, gradually increasing the pressure as it is wrapped round the leg so as to squeeze out anything underneath it. It is then simply left in position, and fresh strips are applied in the same manner, overlapping the edges of the former. In this way the whole surface of the ulcer is covered with protective. Outside this protective, and overlapping it well in all directions, I generally apply a thick mass of cyanide gauze, with some salicylic wool outside the gauze, and then a fairly firm bandage.

The dressing should not be changed for at least five days after the operation, and it may in most cases be quite well left for a week. When it is removed, it will almost always be found that if the operation has been properly carried out, the whole of the grafts have taken, and the surface of the ulcer is practically healed. Care must of course be taken not to detach any of the grafts in changing the dressing, because, although they have become adherent, the adhesion is still comparatively

slight. The surface of the grafts having been washed with weak sublimate solution (1-4000 or 1-6000), fresh protective and gauze is applied for another week. In about a fortnight, I generally substitute weak boracic ointment for the former dressing, and go on with this for some three or four weeks, not that the wound is not healed, but to avoid the drying up of the surface of the grafts which is apt to occur. With regard to the part from which the skin has been taken, the best dressing is weak boracic ointment covered with boracic lint and a bandage. This may be left on for about ten days, when, as a rule, the whole, or, at any rate, the greater part of the surface will be found to have healed over. In the course of time, the region from which the skin has been taken assumes a more and more normal appearance, so that after a year or two fresh grafts might if necessary be taken from the same surface.

Where an ulcer has been made to heal in this way, it is of great importance to prevent the patient walking too soon. In the first instance, of course, the graft is only attached to the deeper parts by lymph, and subsequently by new cell growth, and the complete reorganisation of the graft, and the complete and intimate union of it with the deeper parts—especially the formation of elastic tissue passing from the deeper

parts into the graft, is a process which is not completed for several months, and if the patient is allowed to walk about too soon, hæmorrhage is very apt to occur between the grafts and the deeper parts and lead to their detachment. Hence it is well after an ulcer has been healed in this way, to tell the patient not to hang down the leg or to walk about on it for from three to six months. If he follows that advice, one may reckon that a large proportion of ulcers, even although they may have been intractable or in an unhealed condition for years, will remain permanently sound. This being the case, I consider that skin grafting is a procedure which should always be employed in ulcers of the leg.

As regards the method of skin grafting by using the whole thickness of the skin, I employed that at one time in a number of cases, and no doubt where these grafts were applied and took, the result was extremely satisfactory. The objection, however, to this plan is that, in the first place, the grafts do not take with at all the same certainty as Thiersch's grafts take. As I have already said, one may almost reckon on success with Thiersch's method, if only the operation has been properly carried out on the lines which I have described; but where the whole thickness of the skin is employed, however careful one is, whole

grafts or portions of the grafts will almost certainly die. It is not at all unfrequent in such cases to obtain union of the graft as a whole, but to find that a small slough forms in the centre of the graft, and probably this is because the skin tends to curl up, and although applied flat over the surface of the sore, the centre becomes raised and does not acquire proper adhesion beneath. Another objection is that where the whole thickness of the skin is employed, great care must be taken that all the fat is removed. The actual deeper layer of the dermis must be in contact with the surface of the ulcer, and this is a procedure which takes a considerable amount of time, and which it is not at all easy to carry out properly. A further objection to the employment of the whole thickness of the skin is that the skin retracts, so that what in the first instance was a large piece of skin, by the time it has been prepared and made ready to apply to the ulcer, has become a comparatively small piece, and it is surprising how much skin one must use in order to completely cover a comparatively small ulcer. On the whole, I believe that an equally satisfactory ultimate result is obtained by Thiersch's method as by employing the whole thickness of the skin, while the operation is much more satisfactory and more easily performed.

I may now mention one or two points with regard to

the treatment of some of the forms of ulcers which I have previously referred to. As regards the *simple* ulcer I need not say anything. The simple ulcer is one which is prevented from healing by various local causes, and if these causes are removed, and the limb placed at rest in a suitable position, the sore will quickly heal. Where, however, the sore has become *inflamed*, and we have the condition of inflamed ulcer, it is necessary to take measures with the view of combating this inflammation, and these must consist in the first place, and most essentially, in the elevation of the part, and secondly, in the employment of warm compresses, the best being the boracic poultice which I have already described; or, where the inflammation is progressing very rapidly, the use of cooling lotions such as lead and opium lotion. In the case of inflamed ulcer, also, considerable benefit will be obtained from making incisions into the inflamed tissues, and this is more especially the case where there are several ulcers which are separated by narrow bridges of skin. By cutting across these bridges the tension will be relieved, local depletion will be carried out, and the exuded material underneath is enabled to escape, and in this way narrow bridges of skin, which would otherwise almost certainly slough, will be saved. This treatment by boracic poultices or by lead and opium lotion must not of course be con-

tinued once the inflammation has subsided, otherwise one is apt to get a weak ulcer. Once the inflammation has come to a stop, the treatment must be conducted on the lines already described.

In the case of the *weak* ulcer, the cause which is leading to the weakness must be sought for and removed, especially difficulty in contraction of the surface of the ulcer, general anæmia of the patient, &c. Stimulant applications are usually advised for these ulcers, such as weak solutions of sulphate of zinc (red lotion), sulphate of copper, nitrate of silver, &c. Where it is due to difficulty in contraction, means must be taken to permit this to occur, as, for example, by lateral incisions. When the sore is adherent to bone, portions of bone have been removed, or even joints excised, to relieve the tension. In the case of the *irritable* ulcer, occurring above the malleolus in neurotic women, the best treatment is to thoroughly cauterise the ulcer by nitrate of silver, so as to destroy its base completely, and subsequently to carry out the treatment on the principles previously mentioned; the menstrual functions must more especially be attended to. The *phagedænic* ulcer, of course, requires energetic destruction of the gangrenous tissue. It may be carried out either by the actual cautery, which is apparently the best method, or by caustic potash, which, however, is apt to do more than

is required, or by nitric acid, which, on the contrary, seldom penetrates sufficiently deeply. Subsequently to the application of the strong escharotic, pure carbolic acid may be sponged over the surface, and then a dressing of strong carbolic oil applied. The *varicose* ulcer must be treated on the lines already mentioned, and, in addition, steps must be taken to improve the condition of the veins by operation. It is, on the whole, best to defer the operation for varicose veins (excision of portions of the vein) till after the wound has thoroughly healed. Operations for varicose veins, should the wound become septic, are of course extremely dangerous, and, while the wound remains open, it is always possible that the asepsis may not be complete and that the operation wounds might become soiled.

The ulcer with regard to which we need speak most in detail is the *callous* ulcer. Here, as I have already said, the obstacle to healing is the callous condition of the surrounding parts, and our first efforts must be directed to getting rid of this condition. As a matter of fact, if the part is put at rest, the leg being elevated and the sore rendered aseptic, this callous condition will comparatively quickly subside, so that in the course of two or three weeks the sore will present a healthy appearance and healing will commence. Where it is desirable to expedite matters, or where the

thickening of the tissues does not disappear rapidly, various plans have been employed. Of these I may mention, as perhaps the most efficient, blistering. The effect of a blister applied over the thickened parts is to set up an increased circulation of blood through the part, and consequently an increased circulation of lymph; and the result of the blister is usually in a few days very great improvement as regards the thickening of the tissues. As a rule, the blisters should only be applied to the skin around the ulcer, and should not extend over the surface of it. A number of the patients who suffer from this form of ulcer are also the subject of kidney disease, and if the blister is applied over the surface of the ulcer, a considerable quantity of the cantharides may be absorbed and lead to congestion of the kidneys and serious consequences. Another method which is very much employed is pressure. This may be employed either in the form of strapping, the strips of plaster beginning below the ulcer and crossing in front of it, a hole being cut at the lower part to allow the escape of discharge from the cavity of the ulcer; or again, an elastic bandage, more especially Martin's elastic bandage, may be employed with advantage. Massage will also speedily get rid of the effused material, the rubbing being employed, in the first instance, at the upper part of the leg in the way

which I have already mentioned. Again, lateral incisions have been recommended with the view of allowing the escape of the exudation into the cellular tissue, and of permitting the edges of the sore to contract. On the whole, however, I think that the best plan is usually to remain content with elevation and rest, or, if time is a matter of consequence, to apply blisters.

The callous edges having been got rid of, and the sore having assumed a healthy condition, skin grafting should be employed, and if, when the swelling of the parts has completely subsided, varicose veins are found, they must be operated on after the wound has healed.

Callous ulcers occur more especially in the very poor, who are unable to submit to the necessary treatment, and it is often a matter of great difficulty to persuade them to come into the hospital or to remain away from their work for the length of time which is requisite in order to effect a complete cure. Hence, one has often to treat them as out-patients, and, in that case, one can hardly hope for a cure. The utmost that one can expect is alleviation of the pain and discomfort, with possibly a gradual improvement in the condition of the sore. If the patient is to be allowed to walk about with a callous ulcer, the first essential, after having rendered the sore aseptic, is to give the part adequate support, so

as to aid the return circulation when the patient assumes the vertical position. For this purpose bandages are necessary, and as an ordinary bandage practically affords no support, one must employ either an elastic bandage or else ordinary bandages which are stiffened by gelatine or other material which solidifies.

The form of elastic bandage which is usually employed now is Martin's pure rubber bandage. Originally it was applied directly to the sore without any dressing intervening, and the instructions given were to take it off at night, thoroughly wash it, and hang it up to dry, and then in the morning, after having washed the sore, to re-apply it before getting up, without using any dressing whatever. In applying the bandage, it must be put on loosely, otherwise, if the turns are applied tightly, the pressure accumulates, and thus, especially towards the upper part, a very tight constriction may be brought about. The bandage should be simply rolled round the leg loosely and evenly. After the patient has stood a short time, the leg begins to swell, and the bandage becomes firm and helps to resist any further distension. The original Martin's bandage was unperforated, and the result was that the sweat could not escape, and if a condition of varicose eczema was present, this was very apt to become exaggerated. Now, however, these bandages are perforated so as to permit of the drying up of the

sweat. I do not myself approve of the method of applying the bandage over the ulcer without any intermediate dressing. It interferes with the aseptic treatment of the sore, and the discharge accumulating beneath it very soon becomes extremely foul, and consequently very irritating; hence, I always apply an antiseptic dressing to the sore before putting on the bandage, the best being the protective and boracic lint previously described. It is well to avoid greasy substances such as ointments, because they spoil the rubber, and then fresh bandages must be obtained at frequent intervals. There is no question that great benefit is derived from the use of Martin's bandage, and in a certain number of cases the sores may even heal.

Unna has introduced, in preference to the Martin's bandage, an arrangement by which ordinary bandages are stiffened, and do not slip down. His method is shortly this. In the first place, he thoroughly disinfects the skin, washing it with soap and water, and subsequently with antiseptic lotions, and powdering it and the sore with iodoform. He then takes a double-headed bandage, and commences from the middle of the sore, making one end of the bandage go upwards and the other downwards. This bandage is a porous one, and over it he applies a mixture of gelatine and glycerine, 10 parts of gelatine to about 40 parts of water and 40 parts of

glycerine, to which some oxide of zinc is added in order to make it stiffer. This is melted and rubbed into the bandage, and before it has set, another bandage is taken, dipped in hot water, and applied over it. The whole thing solidifies, and forms a firm support to the leg, while, at the same time, it has not the weight or the dense hardness of plaster of Paris, and, further, some of the disadvantages of Martin's bandage, especially the irregularity of the pressure, are avoided. This dressing is renewed according to the amount of discharge, usually at first every other day, but as the discharge gets less, at less frequent intervals. It is readily removed by putting the patient's leg in a tub of warm water, which melts the gelatine, and allows one to unwind the bandage quite easily. Those who have compared the effect of Martin's bandage and Unna's method, speak most highly in favour of the latter.

When an ulcer has healed, whether it is by skin grafting or naturally, it should be supported for some time with a light bandage and pad, or even with Unna's bandage. Massage should also be used if the scar is fixed and hard, and the muscles are atrophied. The leg should be frequently placed in a warm bath, and lanoline should be rubbed into the skin.

In the case of the *paralytic* ulcers, stimulant applications should be used in addition to the ordinary methods

of treatment, more especially the application of spirits of wine to the parts around. As a dressing, balsam of Peru sometimes acts as well. In the case of *perforating ulcer* of the foot, very radical measures are necessary in order to obtain healing. One may place such a sore at rest and in an elevated position for a long period of time, without obtaining the slightest attempt at healing, the reason being, as I have already pointed out, that the epithelium has spread down the sides of the funnel, hence, in order to obtain healing, it is necessary to cut away the edges and the sides of the ulcer. The orifice of the ulcer, and the whole of the sides down to the bottom, should be completely and widely excised. The bottom of the ulcer should then be scraped, and the whole cavity stuffed with cyanide gauze sprinkled with iodoform. In the case of the *pressure* ulcer, also, it is necessary to remove the callosity on each side of the ulcer.

THE CHRONIC INFECTIVE ULCERS.

There are several infective diseases which lead to the formation of ulcers, but there are only two which I need refer to, namely—tuberculosis and syphilis. Without going into minute details, tubercular ulcers of the skin may be roughly described under three forms, namely—the ordinary tubercular ulceration, which generally

occurs after the bursting of an abscess which has formed under the skin either primarily or secondarily to suppuration in a deeper seated gland. This form is characterised by discoloration of the skin around, thin undermined edges, and a soft, pale, unhealthy base. These ulcers do not heal on account of the presence of the tubercle, and also because the undermined skin is so thin that there is no possibility of its adhering to the deeper parts; indeed, in some cases, the skin has become so thin that the deeper parts of the hair follicles and glands have been opened into, and epithelium has spread from these points over the under surface, so that even although the conditions of healing became more favourable, the thin skin could not adhere to the deeper part, because it has already become covered with epithelium.

Secondly, we have the tubercular ulceration of skin resulting from lupus vulgaris, where tubercles have been deposited in the superficial layers of the dermis, leading to the formation of typical lupus nodules, which break down, forming an irregular ulcer with soft nodular base, and with nodules around the margin. Intermediate between these two, we have the condition of scrofuloderma, where the tubercles have probably become deposited in the deeper layers of the dermis, and so lead to an ulcer presenting an appearance intermediate between that of the tubercular ulcer of the skin and of

the lupoid ulcer; that is to say, in some parts there is a tendency to nodular formation, while in other parts there is an imperfect undermining of the skin; the ulceration extends more rapidly than that of lupus.

The *treatment* of these tubercular ulcers consists essentially in the removal of the tubercular material. They must no longer be looked on as due to a constitutional taint only, and the efforts to obtain healing must not be limited to the treatment of the general condition. They are essentially local affections, depending on the growth of tubercles in the part, and their treatment must be essentially local, and consist in the removal of these tubercles. This may be effected in various ways, the choice of the method depending, in the main, on the extent and situation of the disease. In cases of true tubercular ulceration—which is not usually very extensive, and which is more often situated on the neck or the extremities than on the face—the best treatment is complete excision of the whole area, with, at the same time, removal of tubercular glands, if present, of carious bone, &c. Such a wound, after complete removal, may, in some cases, be brought together by stitches, the edges of the skin being loosened; or, if the wound is too large, healing can be rapidly obtained by skin grafting.

Where, for some reason or other, such as the size or

situation of the sore, excision is not advisable, the undermined skin must be thoroughly slit up (though not necessarily removed) in various directions, and the surface of the sore must be scraped, with the view of getting rid, as far as possible, of all the tubercular growth. In the case of the tubercular ulcer, it generally suffices, after scraping away all the surface, to apply undiluted carbolic acid, and then subsequently to treat the sore on the lines already laid down in speaking of ulcers. Such sores are, however, very apt to become weak ulcers, and whether from constitutional debility, or not uncommonly from fresh tubercular infection, considerable difficulty is often experienced in getting them finally to heal. One must change the dressings and the method of application from time to time. For a time, immediately after the scraping, one may use cyanide gauze sprinkled with iodoform; this again may be changed for gauze impregnated with balsam of Peru; or again, it may be changed for ointments of various kinds.

In the case of lupus, our choice lies between excision or destruction of the lupus nodules in some less effectual manner. The most satisfactory manner is by excision, but in some cases the lupus is so extensive that one hesitates to carry out this method of treatment. Where there is a small group of lupus nodules on the face—provided they are not on the tip of the nose

—excision will lead to less deformity than any other method, and will, at the same time, give a more satisfactory result as regards cure; the patch is enclosed in an oval incision, and the edges of the skin brought together again, possibly with buried stitches, and thus a delicate linear scar will result. Where the lupus is more extensive, excision and subsequent skin grafting yield very excellent results, and I have carried out this treatment, even in cases where there has been most extensive disease of the face, with remarkable success. Soon after the treatment the newly grafted areas seem hard, and show the scar to a greater extent than after scraping; but as time goes on the scar becomes soft and movable on the deeper parts, and the deformity becomes comparatively slight, while, at the same time, the whole or the greater part of the diseased area is radically cured. Further, the contraction resulting from this method is very much less than after scraping the wound and allowing it to heal by granulation, or than in cases where the lupus has recovered of itself; consequently this plan is to be specially recommended where the lupus patch is in the neighbourhood of the eyelid, where, during the healing process, the lid might be seriously drawn upon.

Where it is decided to employ scraping, this must be very thoroughly done, the greater part of the disease

being removed, in the first instance, with a large sharp spoon, and then with finer spoons, the whole surface being ultimately gone over with a very small spoon, such as is used in the treatment of meibomian cysts, so as to clear out all the small recesses of the fibrous tissue. After the bleeding has been thoroughly arrested, the raw surface must be cauterised, with the view of destroying any tubercles which may have been left behind, and I believe that the best caustic for this purpose is nitric acid. Nitric acid should be freely and thoroughly applied to the whole surface, and after about five minutes have elapsed, its action may be arrested by pouring on a saturated solution of carbonate of soda. When effervescence has ceased, it is evidence that the nitric acid has been neutralised, and if the nitric acid has been thoroughly neutralised, the subsequent pain is but slight as compared with that where this neutralisation has not been completely accomplished. Pieces of boracic lint soaked in the carbonate of soda are then placed on the surface for some hours, and later on this is changed for boracic ointment, in the first instance of full strength, and subsequently diminished in strength as the sore tends to cicatrise. With this method more rapid healing could be obtained after granulation has occurred by the use of skin grafting, and possibly with less contraction, but I do not

think that it is a matter of very great importance, because it is seldom that one eradicates the disease completely, however thorough the scraping and cauterisation, and the result is that a tubercular deposit forms under the skin graft, and the condition is reproduced.

I do not propose to go fully into all the methods of treatment of lupus, and have only referred to the two chief methods which I should myself employ in most cases of lupoid ulceration. In cases where we have to do with isolated nodules of lupus, I believe the employment of Unna's salicylic and creosote plasters according to his directions — that is to say, using the strong plaster for two to three weeks, and subsequently allowing the wound to heal under the mild plaster—is probably preferable to the method of scraping out the individual nodules and burning the cavity with nitrate of silver, or to the other methods, such as scarification, &c., which are sometimes employed.

As regards the condition of scrofuloderma, the treatment must be similar, but in most cases I think that scraping and cauterisation yield a fairly satisfactory result.

As regards syphilitic ulcers, I need say practically nothing. Their treatment, of course, is the treatment of the constitutional condition, and they will usually heal rapidly if only large enough doses of iodide of

potassium are administered, the fault generally committed being that the physician rests content with 5 or 10 grains of iodide of potassium at a dose, instead of going up to 25, 30, or more. Where healing is slow, especially where the ulceration is not due to the presence of a gummatous nodule, but is the superficial form of ulceration occurring at the early stage of the tertiary period, the application of emplastrum hydrargyri, renewed every day, will aid the action of the iodide of potassium. In some cases, in feeble individuals, Gibert's syrup gives excellent results. It is seldom that one scrapes or removes a syphilitic ulcer, but I must say that I see no objection to doing this in cases where the ulceration is obstinate; on the contrary, I believe that great advantage will thereby be obtained, more especially where the bone beneath is also involved

Ulcerating Tumours.

As regards ulcerating tumours, the treatment here, of course, is not carried out with the view of getting the ulcer to heal, but with the view either of eradicating the disease, or of alleviating the troubles of the patient. The eradication of the disease naturally means the removal—preferably by excision—of the whole malignant tumour, and the decision with regard

to that must depend on its site and the possibility of such removal. As regards the discomforts which it is necessary to alleviate in such cases, they are chiefly the foul condition of the ulcer, and the great pain which sometimes accompanies it. It is an excessively difficult thing to get rid of the foul condition of the ulcer, and it is important in trying to get rid of it not to employ irritating antiseptics, because these will only lead to more rapid extension of the growth. Frequent washing of the surface with sanitas, peroxide of hydrogen, Condy's fluid, &c., powdering it with iodoform, and applying iodoform ointment and boracic lint, will, in most cases, answer best. Where the smell of iodoform is objected to, the sepsis can also be very considerably diminished by the use of the powdered double cyanide of mercury and zinc, which is employed for impregnating the cyanide gauze. This powder may either be dusted over the sore, or, still better, may be mixed up into a paste with a weak sublimate solution, and this paste introduced into all the crannies of the ulcerated surface. Where there is much pain, the antiseptic ointment may be alternated with ointments containing cocaine or morphia, and, of course, in cases where the disease cannot be operated on, there can be no objection to injections of morphia subcutaneously, repeated whenever the pain recurs and becomes severe.

TREATMENT OF ABSCESSES.

TREATMENT OF ABSCESSES.

SUPPURATION in the substance of the tissues must be divided into acute and chronic, and as the pathology of these two forms is quite different, and as consequently the treatment is not the same, we must consider each form separately.

ACUTE ABSCESS.

In this case, suppuration occurs under two forms:—(*a*) the pus is contained in a well defined cavity—the ordinary circumscribed acute abscess; (*b*) the pus infiltrates the cellular tissue, and there is, in the early stage at any rate, no well defined limit or wall surrounding it—diffuse cellulitis.

Acute suppuration in the tissues is always due to micro-organisms, and by far the largest number of abscesses owe their origin to the growth of the pyogenic cocci to which I have already referred, the circum-

scribed acute abscess most commonly containing staphylococcus pyogenes aureus, or albus, while the diffuse cellulitis is practically constantly due to the streptococcus pyogenes. The mode in which the acute abscess is formed is best seen if one studies the development of abscesses in connection with pyæmic emboli. In these cases, what first happens is the deposit of a mass of pyogenic cocci in the part, and the tissue immediately surrounding this mass in the first instance passes into the condition of "coagulation necrosis," while that which is further away, and in which the irritating products of the bacteric growth are more dilute, show the signs of inflammation. This inflammation goes on to the formation of granulation tissue, and ultimately, as the result of the action of the micrococci, of an acute abscess.

It is not necessary that all acute abscesses should commence with the deposit of cocci in the tissues; it is probably not an uncommon occurrence that in the first instance, as the result of some injury or other irritating cause, the early phenomena of inflammation occur in the part, and that then pyogenic cocci, which are present in the blood, or which are carried to the part by the lymph stream, &c., settle there, and set up the further changes which result in an acute abscess. However that may be, as I have already said, an acute

abscess, or a diffuse cellulitis, is always due to the growth of pyogenic micro-organisms.

We may trace the pathological changes very shortly, as follows:—In the first instance, we have all the phenomena which accompany the early stages of acute inflammation, namely, increased rapidity of the flow of blood, with subsequent slowing and possibly ultimate stasis, dilatation of the blood vessels, and exudation of white corpuscles and liquor sanguinis. The cause of the inflammation continuing to act, or, as I indicated in the second supposition mentioned above, fresh causes of inflammation coming into play, the process goes on to the complete destruction of the tissue which is the seat of disease, and the formation of a new, embryonic tissue, which is termed granulation tissue, and thus we come to have in the affected area a mass of embryonic granulation tissue. The irritant still continuing to act, we find that towards the centre of this granulation tissue liquefaction occurs, and fluid containing numerous cells in suspension is formed, in other words, pus. Once an acute abscess has formed in this way, the process extends, till ultimately the abscess reaches some free surface and there discharges itself, and the law which governs the direction and extension of the abscess is that it spreads along the tissues which are of greatest vitality. Thus, if an abscess forms beneath

a dense fascia, the suppuration spreads along the planes of the cellular tissue beneath (burrows as it is termed), for long distances instead of passing directly through the fascia, and a considerable time must elapse before an opening occurs in the fascia either as the result of granulation of the dense fibrous tissue, or as the result of sloughing of the fascia. Thus, in the case of abscesses occurring in the deeper seated tissues, we generally find that we have not to do with a globular cavity but with one which shows recesses in various directions, and this is a point of excessive importance to bear in mind from the point of view of treatment. For if one in such a case contents oneself with a simple incision through the skin, the great probability will be that the pus will not escape freely from some of these deep recesses, and as a result, the discharge of pus will continue from the opening which has been made, and further burrowing of the pus takes place in connection with the imperfectly drained cavities. This is perhaps best seen in cases of suppuration in the mamma, where the abscess cavity is practically multilocular, on account of its subdivision by the lobules of the breast, and where, consequently, unless special care is taken when the abscess is opened to break down the various septs which subdivide the cavity, suppuration may go on, and fresh sinuses form.

Acute abscesses occur in any part of the body, the most important regions—as implying differences of treatment—being the skin, the subcutaneous tissue, beneath fasciæ, in glands, in connection with the periosteum and bone, about the anus, in tendon sheaths, and in various serous cavities, more especially the pleuræ. As to the causes which set up acute abscess, as I have already said the essential cause is the presence of pyogenic organisms, but these can only produce the result under special circumstances such as I have already indicated when speaking of suppuration in connection with wounds.

These organisms may reach the part in which the abscess subsequently forms either by (i.) direct extension through the tissues from some neighbouring abscess, or from some free surface such as the skin, or by spreading up ducts as in certain cases of suppuration of the breast, where they spread up the milk ducts; or (ii.) through the lymphatic vessels; or (iii.) through the blood vessels. As to the mode in which they gain entrance to the blood we are not as yet thoroughly acquainted. Most usually they get into the blood at some part distant from the abscess, where an ulceration, or at any rate, a weak spot has been formed. For instance, where the patient is the subject of a boil, the organisms may enter the blood, and, reaching some weak

part at some distant part of the body, may there set up an abscess. Similarly, they may enter from wounds or ulcers in the mouth and throat. Kocher is of opinion, however, that most often, especially in cases of acute periostitis or osteomyelitis, they enter from the intestine, because in these diseases there is generally a history of some intestinal derangement, usually diarrhœa, for a few days preceding the onset of the disease.

The second form of acute suppuration, namely, *diffuse cellulitis*, is a very much more serious disease than that which we have just been considering. In this case the organisms spread with great rapidity, probably along the lymph spaces and lymphatic vessels in the cellular tissue, and no proper wall of leucocytes is formed, at any rate in the early stages. As a result, the tissues become infiltrated with a small quantity of pus, which it is impossible to get rid of by comparatively small incisions; and not only are the tissues infiltrated with pus, but those which are least vascular, at any rate, die to a considerable extent, and consequently, when incisions are made, we have an escape not only of pus, but also of sloughs of fascia, fat, &c. The great danger of this condition lies in its rapid extension, and more especially in the entrance of these streptococci into the blood, setting up the condition of pyæmia.

As, to some extent, intermediate between the acute and chronic abscesses, we have a certain number of cases where the abscess does not spread with the same rapidity, but, at the same time, is not at all chronic in its course and character, forms which may be spoken of as subacute abscesses. These subacute abscesses are also generally due to pyogenic cocci, more especially to the less virulent varieties, and it is in them, as a rule, that the rarer pyogenic cocci and pyogenic bacilli are found. In actinomycosis, also, the suppuration which occurs is generally of this subacute variety, but this form of suppuration is rare; it is perhaps most often seen about the jaws, and the condition is usually recognised by the presence of yellow or orange-yellow grains of actinomyces in the pus. Subacute, or even acute abscesses may also be due to the bacillus of glanders.

TREATMENT.

The treatment of an acute abscess consists in the first instance in the earliest possible evacuation of the pus. Once the signs of acute inflammation have existed for four or five days, even though one cannot make out distinct fluctuation, pus will almost certainly be found on opening up the hardest part of he swelling, and therefore I think it is well, under such

circumstances, to make an incision without further delay There is no object whatever in waiting for the presence of fluctuation, because to do so is simply to allow the abscess to extend further, while even though pus is not found, or only in an extremely minute amount, free incisions into the part will usually arrest the process. Hence, I should lay down the rule that in cases where it is evident that we have to do with inflammation going on to suppuration, the earlier an opening is made into a part the better.

Where an acute abscess is opened, the skin incision —unless in situations such as the face or neck, where the size of the scar is a matter of importance—should be free,—sufficiently free, at any rate, to allow the surgeon to introduce his finger. Having made the incision into the abscess, the surgeon introduces his finger with a view of breaking down the septa, to which I have previously referred as present in deep-seated abscesses, and of making sure that all the recesses in the cavity are freely opened up. This cannot be satisfactorily done without the aid of touch. In cases, however, where the abscess is superficial, or in cases where, as in the face, a scar is of great importance, a small incision may be made only sufficiently large to admit a small drainage tube, and the recesses of the abscess may be opened up by introducing a pair of

dressing forceps through the incision and expanding the blades in all directions. In certain cases, such as in the neck, many surgeons use Hilton's method, in which the skin only is incised, and then, with a pair of dressing forceps, the deeper tissues are bored through till pus is reached. No doubt this plan is sufficiently satisfactory in many cases, but I think that with care it is but seldom necessary, and even where it is employed I should strongly advocate the subsequent introduction of the finger for the purpose already mentioned.

Having freely opened the cavity of the abscess, the pus which it contains should be thoroughly squeezed out, and then a drainage tube, which should always be of fairly large size—in fact, the larger the better in the first instance — should be introduced. For my own part, I object strongly to the washing out of these acute abscesses as is done by some surgeons. I do not think that it does any good, while, as I have already repeatedly said, it is apt to damage and depress the vitality of the abscess wall and favour the extension of the process.

In opening an abscess all the usual antiseptic precautions should be taken, the skin, &c., being purified, and cyanide dressings being employed in the manner which I have already fully described. At first sight

this might seem an unnecessary precaution, because these abscesses being due to pyogenic cocci already contain causes of suppuration. In practice, however, it is found that it is of the greatest importance and benefit to treat the abscess strictly antiseptically. It is found that when an abscess is opened antiseptically, suppuration ceases from that time. On removing the dressing, say on the following day, one may no doubt find a small quantity of pus, which, however, is only the residual pus that was present in the abscess at the time of opening, but one cannot, as a rule, squeeze out anything but a little serum, and on the following day there is usually no further pus. On the other hand, if an abscess is not dressed antiseptically, and all the precautions which I have already described are not taken, if, for example, a poultice is applied after the abscess is opened, it will be found that the suppuration goes on, and that days will elapse before this suppuration ceases, and the healing of the abscess will be slower than in cases where the wound has been treated antiseptically; while not uncommonly the process extends and fresh fluctuation becomes evident and fresh openings form.

The explanation of this I take to be the following:—In the pus, and in the granulations forming the wall of the abscess, in the first instance, pyogenic cocci are present in large numbers, and, in the early

stage at any rate, of complete activity. As the result, however, of the opening of the abscess, a quantity of serum is poured out which, in part, sweeps away the cocci and in part destroys them as the result of the largely increased amount of antibacteric material which is thus brought in contact with them. The consequence is that in a day or two the abscess cavity is free from organisms, or if they are present, they are very much diminished in virulence. The wound being treated antiseptically, fresh organisms do not enter, and the result is that we have in this way to do with an aseptic wound. If, on the other hand, a poultice, for example, is applied, while no doubt there is the same pouring out of serum and the same destruction of the bacteria already present in the abscess, fresh organisms at once spread in, and proceed to act and keep up the suppuration. That it is not entirely a question of free drainage is evident in cases where we have suppuration taking place in a wound which is more or less completely open, and where the pus has not been confined in a cavity. In such cases, if we open up the wound completely and introduce a drainage tube, we have not the same pouring out of serum which occurs when we open a tense, acute abscess, and we find that for days after the drainage tube has been introduced, pus can still be squeezed out. Whether this explanation is the correct one or not, the

practical fact remains, as I have already stated, that if an acute abscess is opened antiseptically, and all the septa present in the cavity broken down, and free drainage provided, there will, in by far the greater majority of cases, be no further extension of the process.

As regards the further treatment of these acute abscesses, the dressing should, as a rule, be changed the next day, when it will be found that already the swelling has considerably subsided, and that the tube, which was at the time of the operation of the proper length, is now projecting from the wound. In most cases it is best not to disturb the tube at this period, because there may be considerable difficulty in replacing it; it is sufficient to clip off the portion of the tube which projects externally, so as to leave it again flush with the skin. As to when the dressing should be again changed, that will depend on the amount of discharge. Usually it can be left a couple of days, and then, depending on the size and depth of the abscess and on the amount of discharge, the drainage tube may either be left out on that occasion, or kept in till the next dressing two or three days later.

I may refer very shortly to one or two points in connection with abscesses in special regions. As regards acute suppuration in *glands*, it sometimes happens, if

the abscess is simply opened, that healing does not occur very readily, because, in the gland, there may not only be the large abscess cavity, but there may be one or more small foci of suppuration present, and if the large collection is simply opened, these foci may subsequently give trouble; and further, in the case of acute suppuration in a gland, it is not uncommon for other glands in the vicinity to contain commencing deposits; in my experience this is very likely in cases of subacute suppuration in the glands in the groin. Hence, in the case of acute glandular abscess, I always make it a point, in addition to opening the abscess freely, to remove the whole of the gland, which is usually readily done with the finger introduced into the abscess cavity. In cases where more than one gland is enlarged, and in cases of subacute suppuration in the groin, I think it is best to make quite a free incision, and to remove not only the gland which has suppurated, but also the other enlarged glands in the vicinity. It is so often the case in these suppurations in the groin, especially after chancroid, that while the original abscess does well, fresh suppuration occurs in the other glands, and the case becomes a long one, and a source of disappointment to the surgeon, and not uncommonly of loss of confidence on the part of the patient. This is avoided by removing the various enlarged glands as I have just

mentioned. The same holds good with regard to glands elsewhere, certainly, at any rate, as regards the originally affected gland, but, curiously enough, in my experience, the multiple subacute, non-tubercular suppuration in glands has been practically limited to cases affecting the inguinal region.

As regards suppuration occurring in serous cavities, I may say one or two words on the question of *empyema*. In cases of acute empyema, the collection should be opened as early as possible, and if the pus has not been allowed to remain in the chest till the lung has got firmly bound down by adhesions, the recovery will usually be very rapid provided the operation is properly done, and provided the wound is kept aseptic. In the first instance, the incision into the chest should be free, so as to permit the complete escape of the pus, and also of the masses of fibrinous material, which are so often present. This involves, in the case of children at any rate, the removal of a portion of the rib. In the case of adults, it is possible, in a considerable number of cases, to obtain sufficient access to the cavity of the chest through the intercostal spaces. The chest having been opened, and as much of the pus having escaped as will do so in the first instance, the patient should be allowed to recover to some extent from the anæsthetic, when he will usually commence to

cough, or if he does not cough at once, he will do so on introducing the finger in contact with the lung. The finger being kept in the opening, this coughing on the part of the patient should be encouraged, because the result is that air is forced from the sound lung into the collapsed lung, which is thus gradually expanded. In doing this, the finger should be kept in the opening which has been made so as to prevent the entrance of air, being from time to time removed so as to allow the exit of the pus. In a comparatively short time, in recent cases, the lung will be felt to have more or less completely filled the cavity, and to project close to the opening. Beyond seeing that the cavity is as empty as possible, more especially of the fibrinous masses, I do not think that it is advisable to wash it out, unless in cases where we have to do with tubercular empyema. A drainage tube is then introduced which must efficiently extend into the thoracic cavity, but need not go for any considerable distance; and then, outside, over the orifice of this drainage tube, a piece of protective is placed which acts as a valve, allowing the exit of pus, but preventing the entrance of air, and thus, when the patient coughs, as he should be encouraged to do for some time after the operation, the expansion of the lung can go on.

The dressing in such a case will very likely require

changing, in the first instance, within about twelve hours, and a fresh piece of protective must be immediately placed over the orifice of the drainage tube on removal of the former piece. In the last case in which I opened an empyema in an adult, I left out the tube on the third day, and the result was that the patient was quite well, with a completely expanded lung, in a month, although when the empyema was opened, the chest was completely filled with pus, and the lung absolutely collapsed. In a number of cases at Paddington Green Children's Hospital, the tube has been left out at the end of twenty-four hours with equally satisfactory results; and it is quite evident from our experience that it is a great mistake in the majority of instances to continue the drainage, according to our old rule, till the discharge has become slight in amount. By doing so, one is very likely to have a sinus left behind, the healing of which is very troublesome. I need not go further into this matter, but I may refer the reader to the excellent papers which have been recently published in the *Lancet* on the pathology and treatment of empyema by Dr. G. A. Sutherland.

The only other form of acute abscess to which I need especially allude are the abscesses which occur in connection with bone, cases of *acute suppurative periostitis* and *osteomyelitis*. In these cases, early incision through

the periosteum is a matter of the very greatest importance, and should be carried out as soon as the signs of inflammation of the periosteum and bone have manifested themselves. The incision should be free, both through the skin and through the periosteum; and in cases where we have the typical grave signs of acute suppurative periostitis or osteomyelitis, if one fails to find pus under the periosteum, one should trephine the shell of the bone, and open the medullary cavity. In cases where the incision has not been made so early, and where the periosteum has been extensively stripped from the bone, it becomes a question whether one might not hasten matters by removal of the exposed portion of bone; but if the wound is treated antiseptically, in most cases the greater part, and sometimes all the exposed bone, will recover; and, therefore, unless in a case where the whole shaft of the bone is involved, and where the epiphyseal lines are destroyed, and where therefore it may be advisable to remove the detached shaft, I think it is best to wait till one sees whether the bone will not recover. In such cases, however, I think that the shell of the bone should be trephined and the medullary cavity opened, and if there is pus in the medullary cavity, this should be done in several places over the exposed area.

Diffuse Cellulitis.

The other form of suppuration in the cellular tissue is that known as diffuse cellulitis, where the pus is not confined in a definite abscess cavity, but infiltrates the tissue. This condition is, as I have already said, due to the streptococcus pyogenes, and these organisms not only lead to this diffuse infiltration of the tissues with pus, but also very often to death of shreds of tissue which come away afterwards as sloughs. This condition is a much more grave one than that of acute abscess, in bad cases the patient soon passing into what is known as the typhoid state.

As regards the local appearances, the inflammatory condition spreads with great rapidity, the skin becoming red and brawny, and as suppuration occurs, boggy, but in the early stages at any rate, it is very difficult to make out any definite fluctuation. At a later period, it is not uncommon to find in addition to the infiltration of the tissues with pus, that somewhere or other there is a distinct fluctuating cavity. The infective material spreads along the lymphatic vessels and not uncommonly bursts through the walls of these vessels at various parts of their course, leading to

multiple patches of inflammation; and it is not uncommon for the condition to end in pyæmia.

The treatment of this condition must be very thorough, and consists in permitting free and early exit for the pus and sloughs. A small incision will do no good whatever in this state, because the pus being infiltrated through the tissues would not escape and the process would go on spreading. It is absolutely essential that very free incisions should be made as soon as possible, these incisions extending right through the whole of the inflamed area, and if one incision does not suffice to lay the whole part open, additional incisions must be made till the whole inflamed area is exposed to view. After the incision in the skin has been made, the part should be gently squeezed, and any recesses from which pus wells up, should be thoroughly opened. When one is satisfied that all the recesses have been fully opened, I think it is well, after sponging the wound, to touch the whole surface with undiluted carbolic acid with the view, if possible, of destroying all the micro-organisms, and the results in such cases are sometimes extremely satisfactory. As regards the after treatment, where it can be conveniently carried out, irrigation with a weak antiseptic solution in the manner formerly described is the best form of treatment in the first instance till the wound has become

covered with granulations. Subsequently, the treatment must be carried out on the lines already sufficiently laid down.

The gravity of this condition depends partly on the constitutional effect of the poisonous products of the organisms and partly on the situation of the disease. Diffuse cellulitis is most common in the upper arm, the organisms entering through scratches about the fingers or hand, and the inflammatory process unfortunately does not always remain limited to the subcutaneous cellular tissue, but is apt to extend into the tendon sheaths and lead to very serious interference with the usefulness of the hand should the patient recover, these interferences being due partly to sloughing of tendons, to matting together of the muscles, and to adhesion of the tendons to the tendon sheaths. It is very important in these cases that as soon as the inflammatory condition has passed off, the movement of the fingers and wrist should be encouraged in order to prevent, as far as possible the formation of adhesions, and subsequently when the wound has healed, it is absolutely essential to employ massage, for a long period, and sometimes also occasional forcible movement under chloroform.

In certain cases where the inflammation is very extensive and involves the tendon sheaths to a large

extent, and where the condition of the patient is very grave, it may be necessary to perform amputation, but this can only be done provided the amputation can be carried out well above the inflammatory area.

Another region where this affection sometimes occurs is in the deep cellular tissue of the neck—the condition known as *Angina Ludovici.* Here the organisms enter from the tonsils and spread in the sub-fascial tissues with great rapidity, and very often with fatal results. It is of great importance that these cases should be recognised early, because almost the only hope for the patient's life is free and extensive incisions into the inflammatory area.

Chronic Abscess.

Chronic abscess is practically always due to tuberculosis, and the pathology and treatment of the disease is therefore totally different from that of the acute form. To illustrate the pathology of a chronic abscess, I may describe the method of formation of one in connection with the cellular tissue. The earliest commencement is the formation of a mass of tubercles. These tubercles gradually extend, leading to the occurrence of inflammation around, and the formation

of a nodule, which, in the first instance, is firm in consistence, and more or less freely movable on the surrounding parts. As the nodule increases in size, the older tubercles in the centre undergo caseation, the caseous mass acts as an irritant, fluid is poured out, and also some leucocytes; and thus we come to have a nodule containing a softened centre, the material in this centre being fluid with degenerated fragments of cells and tissue and some leucocytes, while the firm tissue outside constituting the wall of the abscess contains tubercles. Once formed, the natural tendency is for the abscess to increase in size, fresh tubercles being constantly formed in the tissues around, while the older tubercles caseate and break down, the degenerated remains falling into the cavity of the abscess. On making a section of such a chronic abscess, therefore, one finds that the wall is composed of tubercles and imperfectly formed granulation tissue, and, while it is fairly well limited externally, the inner surface of the wall in contact with the abscess is ragged and irregular, and is composed in the main of caseating tissue. Hence, it follows that by simply opening such an abscess and inserting a drainage tube, one merely evacuates the material which has already undergone degeneration, and does not in any way radically attack the essential disease.

It is true that by removing the tension of the wall

due to the presence of the fluid contents, one does, to some extent, remove a cause of inflammation, but, nevertheless, one leaves the greater part of the curative work to be done by nature. That nature will in most cases prove equal to the task, provided only that the wound is kept aseptic, and that no fresh cause of inflammation enters in the shape of pyogenic organisms, and that the general health is kept up, is amply proved by the results which have been obtained in cases of abscesses connected with spinal disease which have been treated by simple aseptic drainage, as was the method employed by Sir Joseph Lister for many years. I have elsewhere given the statistics of cases treated in this way, from which it appears that over 70 per cent. of psoas and other abscesses connected with spinal disease have completely recovered under this treatment. Nevertheless, even in these cases, the period during which the patients were under treatment was exceptionally long, on an average, something like eight months, and during that period the patients were absolutely confined to bed, and at any time an unskilful dresser might make a mistake in his aseptic work and allow the entrance of micro-organisms, thus rendering the former trouble futile.

Since the pathology of chronic abscesses has been more clearly ascertained, and we know that we have to

reckon not only with the contents of the abscess but also with the wall, methods have been introduced which render the treatment of these cases much more precise and satisfactory, and the ultimate results more certain than was previously the case. These methods may be summed up as three in number. (1.) The first and ideal plan is to dissect out the chronic abscess in the same way, or even more carefully, than one would dissect out any cystic tumour. This method of treatment can be carried out in many cases, more especially where we have to do with subcutaneous chronic abscesses, which are not at all infrequent in children, and which are termed by the French, "scrofulous gummata." In these cases a free incision is made over the abscess, and if the skin itself is involved, the affected portion of the skin is included between the incisions, and the whole of the abscess is dissected out, care being taken to avoid, if possible, opening into the cavity or leaving any portion of the wall behind. If this is done properly, a clean cut wound is left which heals by first intention, and in this way the whole process may be cut short, and the patient cured in the course of a few days. This method of dissecting out chronic abscesses is not limited to subcutaneous abscesses, it is equally applicable in many cases to abscesses connected with tubercular glands, where, of

course, in addition to removing the abscess wall, the gland from which it spread and all the enlarged glands in the neighbourhood are also taken away, and although one has to make a larger scar than would be necessary simply to open the abscess, the scar is linear instead of presenting the puckered, disfiguring appearance which so often follows spontaneous opening, or even drainage and scraping in these cases.

In cases also where the abscess is connected with bone, it is possible in a certain number of instances to employ this radical treatment, more especially I would refer to chronic abscesses in connection with tubercular disease of the ribs, cases which do not do at all satisfactorily, or, at any rate, not at all rapidly, under any other plan of treatment. In such instances, I always, where the abscess is at all of moderate size, dissect out the abscess wall completely, and remove the whole of the carious part of the rib, taking care to cut through the healthy rib beyond. In such cases, it is true, one cannot remove absolutely the whole of the abscess wall by cutting, because there is practically always pus beneath the rib between it and the pleura, and that portion has to be dealt with by thorough scraping; but I have never yet failed in these cases to get healing by first intention, and satisfactory and permanent cure. Where also abscesses are connected with

other bones, or even with joints, and where they are not of large size, the same method of treatment may be adopted.

(2.) Where it is impossible, on account of the large size of the abscess, or on account of its intimate relations to important structures, to dissect out the wall in the manner which I have described, the next best thing to do is to lay it as freely open as possible, not merely making an incision into which one can introduce a finger or instrument, but such an incision that one can hold apart the sides of the wound and look into the interior; not uncommonly, one can make an incision extending over the whole length of the abscess. Having exposed the interior of the abscess in this way, and having evacuated the fluid contents, one then proceeds to remove the wall as thoroughly as possible, cutting it away at the superficial parts, either with a knife or with scissors; or at the deeper parts, where cutting is not advisable, scraping very thoroughly with a sharp spoon, this scraping being much more satisfactorily accomplished where one can in this way look into the interior and see what one is doing than where one has to do it through a small orifice. Here, also, one can not uncommonly get rid of the wall completely and again obtain a wound which heals by first intention. If, in such cases, the abscess has originated from

bone, one is also able to see and define the extent of the disease, and to chisel or gouge away the affected tissue. Where one does not feel absolutely certain that all the disease has been removed, I think it is advisable to fill the wound, before putting in the stitches, with iodoform and glycerine emulsion, which consists of glycerine, to which is added a small proportion of bichloride of mercury ($\frac{1}{1000}$ or $\frac{1}{2000}$ part), and which contains 10 per cent. of iodoform in suspension. Although I do not place any very great reliance in iodoform as an antitubercular agent, still I think, looking over one's whole experience, that it is not without a certain amount of value. In cases, on the other hand, where a considerable amount of tubercular material is unavoidably left behind, it is best not to stitch up the wound, but to pack it with cyanide gauze which has been thoroughly powdered with iodoform. This packing is left in, in the first instance, for some days, and then subsequently should be renewed daily. Once the wound has become completely covered with healthy granulations, the packing may be left off and stitches inserted, a drainage tube being of course used. Union will then occur in a considerable number of cases at once.

(3.) Lastly, we may have to do with cases where it is impossible, from the situation and connections of the

abscess to treat it in either of the above mentioned ways. These are chiefly cases of abscesses connected with the spinal column, more especially cases of psoas abscess. In such instances it is impossible to lay open the cavity in such a way as to make the whole, or even the greater part, of its extent visible without, at the same time, damaging the strength of the abdominal walls very materially, and therefore we must resort to a less severe method. This consists in making a smaller incision into the abscess, in the case of psoas abscess best in front of the anterior superior iliac spine, and thoroughly squeezing out the cheesy contents. The abscess should then be washed out with a weak antiseptic solution, for which purpose I generally employ a 1 to 6000 sublimate solution, at the temperature of the body, and then the wall must be as thoroughly scraped with a sharp spoon as possible. The washing out and scraping is best performed by means of the flushing spoons introduced by Mr. Barker, care of course being taken in scraping the inner part of the wall not to perforate the peritoneum or to injure the vessels.

After the wall has been thoroughly scraped and the contents washed out, it is well to complete the process by introducing rough sponges held on long dressing forceps, with the view not only of soaking up and

removing the remains of the sublimate solution, but also of detaching any cheesy material or tags which may have escaped the action of the spoon. Having in this way dried the abscess cavity, it should be filled with iodoform and glycerine emulsion (usually from one to two ounces), a considerable part of which subsequently runs out, and then the external opening must be closed by means of stitches. In a large proportion of cases the external wound heals by first intention. In a small number it may heal in the first instance, and subsequently break down. In a certain number of cases, although the external wound heals by first intention, there is found, after a few weeks, a small collection of fluid, and it is well to evacuate this collection again, repeating the whole process at the the same time. As a rule, this fluid is a brownish glairy material, and contains a certain quantity of iodine.

In the great majority of cases permanent healing is obtained either after one operation, or most commonly after two or three. In any case, the length of treatment is short as compared with that required for drainage, while the patient is not subjected to the same risk of sepsis. It is needless to remark that this operation must, of course, be carried out with all the precautions which I have previously mentioned.

In a certain proportion of cases, after the wound heals by first intention, a small sinus forms, and remains open. In some instances it heals again soon, but in other cases, if nothing further is done, it remains open for a considerable time. In most cases where this takes place, if the sinus does not close in two or three weeks, I dissect away the surrounding portion of skin, and open up the canal, and scrape it afresh, injecting iodoform and glycerine, and bringing the edges together after loosening them by lateral dissection through the fat. Such a performance is generally successful, but in a few rare cases, even though it is repeated several times, a sinus again forms, and if that occurs, one must have recourse to the old plan of drainage.

The same principles apply to tubercular empyema, tubercular peritonitis with suppuration, &c.

INDEX.

INDEX.

PAGE

Abdomen, wounds of, ... 87
Abscess, acute, aseptic course, ... 168
„ „ drainage of, ... 167
„ „ dressing of, ... 168
„ „ glandular, treatment of, . . . 171
„ „ mode of formation of, ... 161
„ „ opening of, ... 166
„ „ relation to organisms, ... 163
„ „ treatment of, ... 165
„ chronic, drainage of, ... 188
„ „ iodoform emulsion in, ... 187
„ „ pathology of, ... 179
„ „ removal of, ... 182
„ „ scraping of, ... 186
„ „ stuffing in, ... 185
„ „ treatment of, ... 182
„ sub-acute, ... 165
Abscesses, classes of, ... 159
Accidental wounds, disinfection of, ... 81
Acute suppuration, forms of, ... 159
Anal fistula, treatment of, ... 98
Antiseptics, ... 25
Arrest of hæmorrhage, ... 38
Asepsis, ... 57
Aseptic course of wounds, ... 54
„ fever, ... 5
Attenuation, ... 26

Blisters in callous ulcer, ... 142
Blood clot, healing by, ... 5
Breaches of surface, classes of, ... 3

PAGE

Buried stitches, ... 42
Burns, ... 90
Button sutures, ... 41

Callous ulcer, characters of, ... 116
„ „ treatment of, ... 141
Catgut, ... 38
Cellulitis, diffuse, ... 176
Chloride of zinc, ... 101
Chronic abscess, ... 179
„ infective ulcers, ... 147
Classes of breaches of surface, ... 3
„ wounds, ... 27
Coagulation necrosis, ... 13
Co-aptation stitches, ... 41
Compound fractures, amputation in, ... 85
„ „ of skull, ... 89
„ „ treatment of, ... 84
Congenital fistula, treatment of, ... 98
Contused wounds, treatment of, ... 83

Diabetic ulcer, ... 119
Diet after operations, ... 53
Diffuse cellulitis, ... 176
Disinfection of accidental wounds, ... 81
„ instruments, ... 33
„ nails, ... 32
„ old septic wounds, ... 92
„ skin, ... 29
„ sponges, ... 35
„ ulcers, ... 122
Drainage of wounds, ... 43
Dressings, antiseptic, ... 46
„ changing of, ... 49
„ for ulcers, ... 125

Empyema, acute, treatment of, ... 172
„ drainage in, ... 173
„ tubercular, ... 188
Epidermis grafting in ulcers, ... 128

PAGE

First intention, healing by, ... 4
Fistula, ... 96
„ anal, treatment of, ... 98
„ congenital, treatment of, ... 98
„ intestinal, treatment of, ... 97
„ perineal, treatment of, ... 98
„ salivary, treatment of, ... 97

Granulating wounds, treatment of, ... 73
Granulation, healing by, ... 6
„ disadvantages of healing by, . . . 9

Hæmorrhage, arrest of, ... 38
Hæmorrhagic ulcer, ... 116
Healing by blood clot, ... 5, 60, 70
„ first intention, ... 4
„ „ conditions interfering with, . . 10
„ „ failure of, ... 61
„ granulation, ... 6, 9
„ of wounds, ... 4

Incised wounds, inflicted accidentally, treatment of, . . 83
Inflamed ulcer, ... 113
„ treatment of, ... 139
Inhibition of growth of micro-organisms, . . . 25
Instruments, disinfection of, ... 32
Intestinal fistula, treatment of, ... 97
Iodoform in recent wounds, ... 77
„ in septic wounds, ... 76
„ in ulcers, ... 124
Irrigation, during operations, ... 35
„ of septic wounds, ... 67
Irritable ulcer, ... 113
„ treatment of, ... 140

Joints, wounds of, ... 86

Lacerated wounds, treatment of, ... 83
Ligatures, ... 38
Listerian method, ... 28
Listerism in private practice, ... 55

PAGE

Lotions for septic wounds, ... 78
Lupus, ... 148
„ scraping of, ... 152
„ skin grafting in, ... 151
„ treatment of, ... 150

Martin's elastic bandage, ... 144
Massage in the treatment of ulcers, ... 121
Mercuro-cyanide gauze, ... 46
Micro-organisms, conditions favouring the action of, . . 15
Mucous membrane, wounds of, ... 99

Nails, disinfection of, ... 82
Number of organisms, importance of, ... 17

Ointments in the treatment of wounds, ... 77
„ in ulcers, ... 127
Old septic wounds, ... 91
Osteomyelitis, acute suppurative, ... 174

Paralytic ulcer, ... 117
„ „ treatment of, ... 146
Perforating ulcer, ... 118
Perineal fistula, treatment of, ... 98
Periostitis, acute suppurative, treatment of, . . . 174
Peritonitis, tubercular, ... 188
Phagedænic ulcer, ... 114
„ „ treatment of, ... 140
Phagocytosis, ... 19
Position in the treatment of ulcers, ... 120
Pressure ulcer, ... 117
„ „ treatment of, ... 147
Private practice, Listerism in, ... 55
Protective, ... 52
Pyæmia, ... 8
„ treatment in, ... 66
Pyogenic cocci, how they act, ... 12
„ micro-organisms, ... 11
„ „ „ inhibition of growth, . . 25
„ „ „ relation to chemical substances, . 25
„ „ „ „ culture media, . . 22

PAGE

Pyogenic micro-organisms, relation to heat, . . . 23
„ „ „ source of, ... 20

Relaxation stitches, ... 41
Rest in the treatment of ulcers, ... 120
„ „ „ wounds, ... 51
Rib, chronic abscess in connection with, . . . 183

Sapræmia, ... 8
Scrofuloderma, ... 148
„ treatment of, ... 153
Sepsis in wounds, treatment of, ... 63
Septic intoxication, ... 8
„ open wounds, treatment of, ... 73
Septicæmia, ... 8
Silk for stitches, ... 40
Silkworm gut, ... 41
Simple ulcer, ... 112
„ „ treatment of, ... 139
Sinus, causes of, ... 93
„ classification of, ... 93
„ treatment of, ... 94
„ tubercular, ... 94
Skin, disinfection of, ... 29
„ grafting in recent wounds, ... 72
„ „ Thiersch's, in ulcers, ... 129
„ „ subsequent dressing, ... 135
„ „ with the whole thickness of the skin, . . 137
Skull, compound fractures of, ... 89
Source of pyogenic organisms, ... 20
Sponges, disinfection of, ... 35
„ use of, in dressings, ... 48
Staphylococci, streptococci, differences in action, . . 14
Stitches, ... 39
„ buried, ... 42
„ of co-aptation, ... 41
„ of relaxation, ... 41
Strapping in callous ulcer, ... 142
Suppuration, acute, causes of, ... 160
„ forms of, ... 159

PAGE

Sutures, ... 39
„ button, ... 41
Syphilitic ulcers, ... 153

Thiersch's method of skin grafting, ... 129
Thorax, wounds of, ... 89
Towels, aseptic, ... 34
Traumatic fever, ... 7
Treatment of open wounds, ... 69
Tubercular sinus, nature of, ... 94
„ „ treatment of, ... 95
„ ulcers, ... 147
„ „ treatment of, ... 149
Tumours, ulcerating, ... 155

Ulcer, callous, ... 116
„ diabetic, ... 119
„ hæmorrhagic, ... 116
„ inflamed, ... 118
„ irritable, ... 118
„ paralytic, ... 117
„ perforating, ... 118
„ phagedænic, ... 114
„ pressure, ... 117
„ simple, ... 112
„ varicose, ... 115
„ weak, ... 114
Ulcers, causes of, ... 106
„ chronic infective, ... 147
„ „ non-infective, ... 106
„ „ „ classes of, ... 112
„ classes of, ... 105
„ definition of, ... 105
„ epidermis grafting in, ... 128
„ painful, treatment of, ... 126
„ syphilitic, ... 153
„ treatment of, ... 111, 119
„ tubercular, ... 147
„ tubercular, treatment of, ... 149
„ Unna's dressing for, ... 145

PAGE

Varicose ulcer, ... 115
„ treatment of, ... 141

Weak ulcer, ... 114
„ treatment of, ... 140
Wounds, classes of, ... 27
„ drainage of, ... 43
„ of abdomen, ... 87
„ joints, ... 86
„ mucous membrane, treatment of, . . . 99
„ thorax, ... 89
„ rest in the treatment of, ... 51

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